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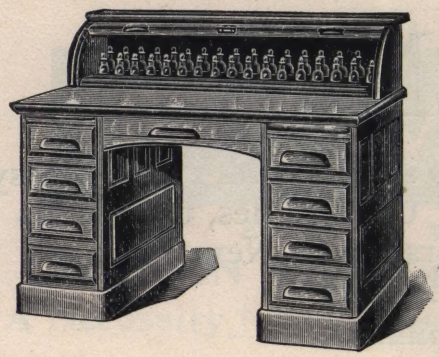

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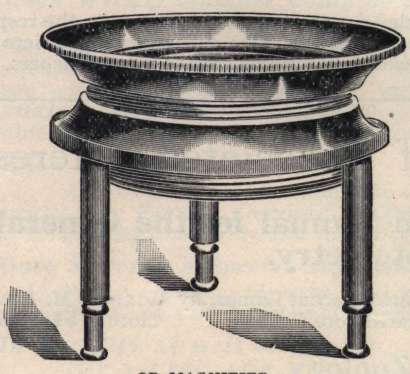

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MICRO-CHEMICAL ANALYSIS.

XI.

AMMONIUM.

The salts of the radical NH_4 resemble so closely, in their behavior, those of the alkalies that it is more convenient to discuss ammonium in connection with the elements of Group I than under the head of Nitrogen.

As has already been seen from the preceding work, ammonium reacts with most of the reagents used for the detection of potassium, rubidium, and cesium. Hence it is usually not practical to test for ammonium directly in the substance. It follows, therefore, that it is generally necessary to first volatilize the ammonia and test for this substance after its separation.

Although the salts of ammonium are easily driven off by heat, any attempt to sublime them and then to test the sublimate will be found unsatisfactory. A far better plan is to expel the NH_3 by the action of an alkali and heat and to absorb the evolved gas in dilute acid. The method of procedure is as follows:

Place in a deep 25 mm. watch glass a tiny bunch of fibrous asbestos which has just been ignited to redness by being held, with the forceps, in the flame of the Bunsen burner. In the absence of asbestos, a tiny piece of thick filter paper can be employed, but in this case the paper must be tested for ammonia.

On the absorbent place a small amount of the substance to be tested and sufficient water to just thoroughly moisten the mass, but no more. Now add a fragment or two of sodium hydroxide so as to obtain an alkaline reaction. Invert over the watch glass thus prepared, a glass slide bearing at its center a minute drop of water acidified with hydrochloric acid.

Hold the watch glass thus covered (by grasping its edges between the thumb and fore-finger) over a small flame (see diagram, Fig. 39) so as to expel the ammonia. The heating is kept up until the slide becomes bedewed with moisture. Heating to boiling should be avoided, since in such cases there is danger of some of the contents of the watch glass spirting upon the slide.

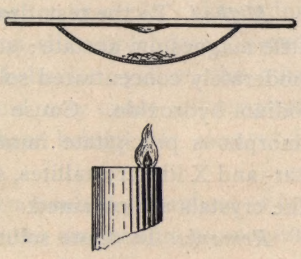


FIG. 39.

Remove the slide from the watch glass and turn it over. Cause the condensed moisture to unite in one drop by stirring with a glass rod. This drop will contain the ammonia which has been expelled from the substance. The danger of a possible loss has been guarded against by the drop of dilute hydrochloric acid employed.

In order to test for ammonium in the drop thus obtained, it is only necessary to add a suitable reagent. Since it is extremely unlikely that any compound other than ammonium chloride is present, a number of methods are available. There are two, however, which will be found more satisfactory than the others.

I. Chlorplatinic Acid (Platinum Chloride).

II. Magnesium Acetate and Sodium Phosphate in alkaline solution.

In practice Method I is the most convenient, simple, and satisfactory.

It is essential that a blank experiment be always performed to ascertain whether the reagents employed are free from ammonium salts.

I. Chlorplatinic acid added to solutions of Ammonium salts precipitates Ammonium Chlorplatinate.

$$2NH_4Cl + H_2PtCl_6 = (NH_4)_2PtCl_6 + 2HCl.$$

Method. Cause a drop of platinum chloride to flow into the drop obtained after the manner described above. In a few moments yellow octahedral crystals of $(NH_4)_2\ PtCl_6$ are obtained. These crystals resemble those of the corresponding potassium compound in size, form, and color. The reader is therefore referred to Potassium Method I, for a discussion of the appearance of the crystals and to Fig. 29 for a representation of their form.

Remarks. When much ammonium is present there is apt to be an immediate precipitation of the chlorplatinate in the form of very minute or skeleton crystals. It is then advisable to add a drop of water and recrystallize by heating. If, on the other hand, the amount of ammonium is small, no crystals will appear until the liquid has been concentrated by gentle heat.

II. The addition of Magnesium Acetate and Sodium Phosphate to alkaline solutions of Ammonium salts gives rise to the formation of Magnesium Ammonium Phosphate.

$$NH_4Cl + Mg(C_2H_3O_2)_2 + HNa_2PO_4 + NaOH =$$
$$MgNH_4PO_4 \cdot 6H_2O + NaCl + 2Na(C_2H_3O_2) + H_2O.$$

Method. To the test drop add a fragment of sodium phosphate and a very little magnesium acetate; stir thoroughly. Beside the drop, place a drop of a moderately concentrated solution of primary sodium carbonate ($HNaCO_3$) or of sodium hydroxide. Cause the drops to flow together. There is generally an amorphous precipitate immediately produced, which soon partly changes into star- and X-like crystallites, see Fig. 40. A little farther away, roof- and envelope-like crystals are obtained.

Remarks. In dilute solutions the Xs and stars are generally absent, being replaced by prismatic forms.

The crystals of magnesium ammonium phosphate belong to the orthorhombic system and have a great tendency to assume hemihedral and hemimorphic and skeleton forms.

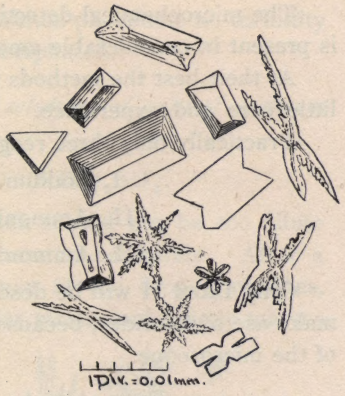


FIG. 40.

Only very little magnesium acetate should be used since either a dense amorphous precipitate of magnesium phosphate will result, or if the conditions are favorable this salt will itself crystallize in star-like prism aggregates.

This method can be applied directly to the solution of the substance without the necessity of having recourse to the separation of the ammonia. When applied directly it is advisable to substitute sodium hydroxide for the carbonate. The objection to this procedure is that many elements are precipitated as phosphates in alkaline solution, and that magnesium hydroxide almost invariably separates as a flocculent mass.

Exercises for Practice.

Expel the ammonia from an ammonium salt by the method above described, and test by Method I.

Repeat, and test the drop by Method II. First employing primary sodium carbonate, then using sodium hydroxide.

Make a mixture of various compounds introducing a salt of ammonium. Test directly by II. Expel the ammonia and test by either I or II.

LITHIUM.

The element lithium can be considered as marking the transition between the alkalies on the one hand and the alkaline earths on the other, and is therefore a link between Groups I and II. Because of this—its peculiar behavior—lithium is worthy of a brief consideration, although it is so seldom that the chemist is required to test for its presence that it should properly not be considered in these articles.

The solubility of its sulphate and oxalate excludes its appearance in testing for calcium, strontium and barium; while its precipitation with ammonium (or potassium) carbonate and sodium phosphate brings it into close relationship with these elements.

With almost all the reagents used for Group I, as for example, chlorplatinic acid, potassium antimonate, tartaric acid, ammonium silicomolybdate, bismuth thiosulphate, etc., lithium resembles sodium in its behavior; yet on the other hand the fact that in rare cases phosphomolybdic acid may cause a precipitate and that hexagons are obtained with bismuth sulphate brings this element in close analogy to potassium.

Lastly, like magnesium, lithium forms a double ammonium phosphate of low solubility. Moreover, this salt is isomorphous with the magnesium ammonium phosphate. In this respect lithium resembles the magnesium group.

The microchemical detection of lithium is satisfactory only when this element is present in considerable amount and in quite simple mixtures.

At their best the methods are apt to prove unsatisfactory and require not a little care and experience.

Practically only three reagents are available; these are:

I. Sodium Phosphate.

II. Ammonium Carbonate.

III. Ammonium Fluoride.

Only I and II will be described, since it is not advisable for the beginner to make use of fluorides, because of the great danger of corrosion of the objectives of the microscope.

I. Sodium Phosphate added to solutions of Lithium salts precipitates Lithium Phosphate.

$$3Li_2SO_4 + 2HNa_2PO_4 = 2Li_3PO_4\ H_2O + 2Na_2SO_4 + H_2SO_4.$$

Method. Allow a drop of a solution of sodium phosphate to flow into a drop of a moderately concentrated solution of the substance to be tested. Heat the preparation almost to boiling. An exceedingly fine crystalline precipitate is at once formed. Examined with a high power, this precipitate is seen to consist of strongly refractive lenticular and fusiform bodies either singly or arranged in cross-, star-, or dagger-like groups which are very characteristic of lithium (see Fig. 41). These crystals extinguish when their length lies parallel to the cross-hairs of the polarizing microscope. Globulites are also formed in abundance, which when examined between crossed nicols show the black cross of "sphero-crystals."

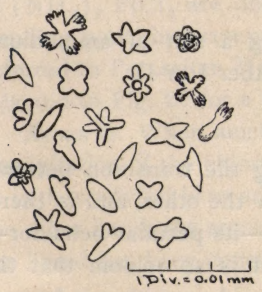


FIG. 41.

Remarks. The reaction should be performed in neutral (or slightly alkaline) solution. If acid, neutralize with sodium carbonate or sodium hydroxide. Since in the reaction an uncombined acid probably results, it is advisable to have a small amount of free alkali present, and in practice it is found that faintly alkaline solutions yield the best results. An excess of alkali is to be avoided.

If much sulphuric acid is present it is advisable to heat the material on platinum until most of the acid has been driven off, after which the residue is dissolved in water and the solution neutralized.

Elements of the calcium group can be advantageously removed by treatment with sulphuric acid or ammonium oxalate.

If much magnesium is present, globulites seem to predominate.

In the presence of ammonium there arises the possibility of the formation of a double phosphate $LiNH_4PO_4 \cdot 6H_2O$: hence if any ammonium salts have been employed in preceding operations, they should be removed by ignition before testing for lithium.

In testing mixtures, if in doubt as to the nature of the phosphate obtained, draw off the supernatant liquor, wash the precipitate, dissolve in dilute acid and

add ammonium hydroxide. If the precipitate was lithium phosphate no turbidity should result, while the alkaline earths are again precipitated.

II. Addition of Ammonium Carbonate to neutral solutions of salts of Lithium causes the separation of Lithium Carbonate.

$$Li_2SO_4 + (NH_4)_2CO_3 = Li_2CO_3 + (NH_4)_2SO_4.$$

Method. To the drop of the neutral solution, which should not be too dilute with respect to lithium, add a fragment of solid ammonium carbonate. After a short time there will appear near the circumference of the drop, globulites, bunches of needles and thin, more or less irregular plates and bristly masses (Fig. 42). The general appearance of these aggregates will vary somewhat with the concentration of the test drop.

FIG. 42.

Remarks. All substances forming difficultly soluble carbonates interfere.

The reaction requires care and experience in order that it can be made to always yield acceptable results.

Since the lithium carbonate separates only after some little time, there are apt to appear, almost simultaneously, crystals of other salts, particularly if the test drop contains sulphates. In such an event add to the drop a little *dilute* alcohol; lithium carbonate will remain undissolved for some time, while the sulphates or chlorides of the other members of the first group will pass into solution.

Exercises for Practice.

Try the above methods for lithium first on a simple salt of this element, then on mixtures of lithium and other members of its group, and lastly try mixture containing ammonium and others containing calcium, magnesium, etc.

EXAMINATION OF SUBSTANCES CONTAINING THE ELEMENTS OF GROUP I.

Ammonium is tested for in a portion of the material by expelling it in the manner previously given.

The material to be tested is brought into solution by any suitable means, not introducing alkalies.

If soluble in HCl, the solution of the chlorides is evaporated to dryness, and, if ammonium salts are present, the residue is ignited until all these salts have been driven off. The residue is extracted with absolute alcohol or with carefully purified amyl alcohol. The alcoholic extract is evaporated to dryness and the residue tested for the members of Group I.

When sulphuric acid has been employed, or if the substance contains sulphates, it is first necessary to convert the material into chlorides; this is accomplished by treating with barium chloride in sufficient amount to precipitate all the sulphuric acid and removing any excess of barium by means of ammonium

carbonate, carefully added. The turbid liquid is then either filtered, or, what is better, whirled in the centrifuge. The clear liquor is evaporated to dryness, the ammonium salts driven off and the residue extracted with alcohol or amyl alcohol.

Or, in the absence of sulphates, another method is open which avoids the use of alcohol. Treat the aqueous solution with ammonium hydroxide and ammonium oxalate, then add sufficient ammonium carbonate to precipitate the magnesium; separate the precipitate by filtration or by means of the centrifuge. Evaporate the clear liquid and ignite the residue. Treat with HCl, evaporate to dryness, and test the residue as given below. This method is open to a number of objections and is somewhat limited in its application.

Test a portion of the material with potassium chlorplatinate or ammonium silicomolybdate for Rb and Cs.

Another portion is treated with platinum chloride for K.

Sodium is tested for with uranyl acetate or, if thought to be in only small amount, with uranyl acetate and magnesium acetate. If much K has previously been found, either separate this element by the perchloric acid method, or test for Na at once with potassium antimonate or bismuth sulphate.

There now remains Li to be searched for. This can be done by any one of the three methods mentioned under the head of this element.

Cornell University, Chemical Laboratory. E. M. Chamot.

Staining Sections for Class Work.

Being under the necessity of staining large numbers of sections of tissues sectioned in both paraffin and in celloidin, for class work, we have adopted the following methods for shortening the time and facilitating the technique.

The paraffin sections being mounted on cover-slips, and the paraffin removed by the usual method, they are placed in rows on a corrugated glass disc of a staining dish, the disc being provided with handles of wire, and resting in a dish of xylol deep enough to cover the sections. Upon this disc or tray the sections can be quickly transferred from one reagent to another, if necessary, allowing the disc to drain upon pieces of filter paper between the different reagents. In this way thirty or thirty-five sections can be stained in a very few minutes on one staining disc.

For celloidin sections, the reagents being in small, deep dishes, the sections are placed on a piece of copper or brass wire gauze, folded into the form of a cup, and resting in a dish of alcohol or water. By means of this porous cup the sections can be quickly transferred from one dish of reagent to another and easily drained; the number of sections that can be stained at once being indefinitely large.

Newton Evans, M. D.
American Medical Missionary College.

Home Made Wall Charts.

I can vouch for the value of Professor Heald's method of making wall charts, described in the November JOURNAL, as many years ago, when connected with the State College of Iowa, I made some very serviceable charts in this way. I soon found that I could use a camel's hair brush for inking the pencil lines. After a little practice one learns just how rapidly the brush must be drawn over the surface to produce the right kind of a line, and to avoid spreading and blotting. I still have a few of these old muslin charts, which are as good as ever, after at least twenty years of service. One great advantage which such charts have over all others is that they may be folded into small, flat parcels, and tucked away in one's traveling bag, and not be any the worse for it, after an extended lecture trip.

Another method of making charts is one which grew out of the foregoing, and which I prefer for charts for hanging on the walls of the lecture room or laboratory, although less convenient for carrying about the country. I buy a roll of "opaque" curtain cloth, white or of a light shade, and about 100 cm. in width. This is cut into sections of the desired length, say 1½ to 2 meters, and on these the desired figures are drawn. I buy one pound boxes of paints, ground and mixed, ready for use. In order to hasten the drying of the oily paint, I take out a little from the box, allowing the surplus oil to drain off, and then mix it with the proper amount of spirits of turpentine to make it flow readily from the brush. The figures having been traced in lead pencil, a good camel's hair brush is used in applying the paint. Since the curtain stuff is a kind of "filled" canvas, its surface takes the paint very easily, and there is no danger of its spreading. When the material is white, colored paints may be used to good advantage. I have been able to get good effects from the use of green, yellow, and brown paints of the quality found in the pound boxes mentioned above. Other colors, especially the reds, and the delicate shades of pink, lavender, gray, etc., are not as satisfactory with these coarser paints as with the "tube" paints, which I have used for finer work, as in cytological charts. For the charts made in black throughout, any good lampblack paint will prove satisfactory.

In mounting the charts, I have found that the best way is to use pairs of pine or whitewood "half round" strips of the proper length, clapping the end of the chart between the two, and fastening them together with small wire nails. They thus form a cylindrical roller at each end, and the cloth is fastened much more securely than when a solid roller is used.

I have a hundred or more charts in the Botanical department of the University of Nebraska, made in this way, and they have been found very satisfactory, while the cost for material has been little.

University of Nebraska. CHARLES E. BESSEY.

Flattening and Fixing Paraffin Sections on Slide.

One of the difficulties in mounting paraffin sections in series is the loss due to imperfect fixing on the slide.

The following methods are generally recommended: *Water* (Lee's Vade-Mecum, sec. 182, 5th ed.); *alcohol* (70 per cent. alcohol is used instead of water. Method described in above reference); *Mayer's albumin* (Lee's Vade-Mecum, sec. 183, 5th ed.). Each of these methods is open to some objections, either on account of extreme care necessary for good results or clouding of sections in staining.

Of these, the alcohol method seems to be the most satisfactory, as it does not require that the slides be absolutely clean, nor are the sections clouded in staining as sometimes occurs in the albumin method. The improvement on the alcohol method suggested by Eisen (Zeit. f. wiss. Micros. Bd. xvi) makes it as certain as the albumin method, without its objectionable features.

The essential steps in the process are as follows:

a. Flood the slide with 70 per cent. to 85 per cent. alcohol. Arrange sections in order. Hold slide a few inches above small flame until sections are flattened.

b. Drain off surplus alcohol (use filter-paper or cloth). Rearrange sections in desired positions.

c. Cut out two pieces of smooth blotting paper same size as slide. Wet one in same strength alcohol as used in (*a*), and place over sections. Over this put the other piece dry. Pass small rubber roller (such as used by photographers), firmly over the dry blotting paper two or three times. Instead of using the roller, any weight with smooth surface may be pressed against the blotting paper. The object of this step is to flatten the sections completely, so that every part of the section will come in contact with the slide.

d. Remove any lint which adheres to the slide and dry in a place protected from dust. At the ordinary temperature of the room, two or three hours are necessary for complete drying. The process may be hastened by keeping the sections at a temperature a few degrees below the melting point of the paraffin (below 40° C).

If this method has been carried out carefully, the sections may be taken through as many stains or reagents as desired, or left indefinitely in any solution which will not act chemically on them.

B. M. Davis.
Biological Laboratory, State Normal, Los Angeles, Cal.

A new building is being erected, at a cost of $125,000, for the Medical Department of Cornell University. It will be the finest building on the Cornell campus, and will offer facilities for scientific and practical study which are not excelled by any institution in the world.

A Ventilated Dish for Bacteria Cultures.

When Koch's original form of plate for bacteria culture was abandoned for the more convenient Petri dish, a step was undoubtedly taken in the right direction ; yet in one respect it was a step backward. Koch's plates were placed for incubation in a large air-tight receptacle, as a bell-jar, which contained wet filter paper. The object of this jar was to prevent the gelatin from drying up as it would do if exposed to the atmosphere of the ordinary incubator. In the Petri dish drying was prevented by making the cover fit the bottom plate tightly —at least such was the intention. As a matter of fact, however, the dishes are seldom air-tight because the bottom plates and covers become mismated in the laboratory. Consequently when Petri dishes are used there is almost always a slight drying of the gelatin. The loss of water by evaporation in the ordinary Petri dish may be as great as 15 per cent. in 72 hours at 20°, but it is ordinarily about 5 per cent. Although this evaporation is comparatively small, it is sufficient to cause a thickening of the gelatin at the surface, and this thin film tends to exclude oxygen from the medium and thus retard or prevent the growth of ærobic bacteria. In a former publication* the writer has shown how the amount of moisture in the atmosphere of the incubator affects the number of bacteria that will develop from a sample of water. The results there set forth were summarized in the following table :

Relative Humidity of the Atmosphere of the Incubator in per cent. of Saturation.	Per Cent. which the Number of Bacteria that Developed in the Incubator was of the Number that Developed in a Moist Chamber.
60	75
75	82
95	98
98	97
100	100

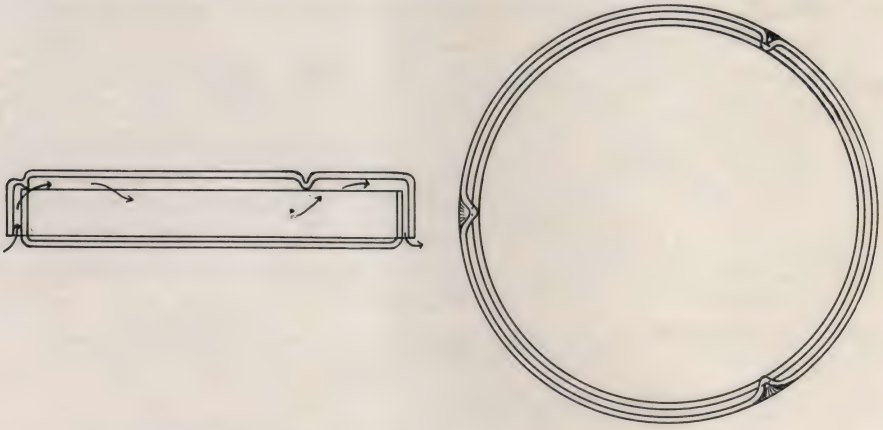
It was also shown that air-tight Petri dishes are unfavorable for the growth of ærobic bacteria, because of the partial exhaustion of the oxygen from the somewhat limited air space and the collection there of gaseous products of growth. For example, the air in five sealed Petri dishes was collected and analyzed after bacteria had been allowed to develop in them for 72 hours, and was found to contain only 5 per cent. of oxygen and 5 per cent. of CO_2 ; whereas in ordinary Petri dishes with ill-fitting covers the percentage of oxygen was 15 per cent. and of carbonic acid 2 per cent.

From these two facts, that an air-tight Petri dish gave too low results on account of exhaustion of oxygen and that an ordinary Petri dish gave too low results on account of evaporation of moisture, it was argued that the best conditions would be obtained by cultivating bacteria in a ventilated dish placed in an

*On the Necessity of Cultivating Water Bacteria in an Atmosphere Saturated with Moisture. Technology Quarterly, Dec. 1899.

incubator of which the atmosphere was saturated with moisture. Thus drying of the gelatin was prevented and a sufficient amount of oxygen was provided. Experiments showed that the results obtained from these conditions warranted the trouble necessary to provide them. The atmosphere of the incubator may be easily kept nearly saturated by shallow pans of water placed beneath the shelves, and ventilation of the dishes may be accomplished in a number of ways.

I have recently had made a very convenient form of ventilated dish, which is shown in the accompanying diagram. The cover is supported about 2 mm. above the lower plate by means of three projections of glass, which are merely



indentations in the cover, obtained by heating the edge and pressing in the softened glass with a sharp point. The sides of the cover are made deeper than in the Petri dish by an amount about equal to that which the cover is raised above the dish. With the cover thus elevated there is abundant opportunity for a free circulation of air, as indicated by the arrows. Ordinary Petri dishes may be thus ventilated, but unless the work is done by a skilled glass-blower the breakage is liable to be great. Furthermore, the cover of the ordinary Petri dish is too shallow.

If the ventilated dish is desirable for the cultivation of ærobic bacteria, it is even more necessary for the cultivation of anærobic forms. When these ventilated dishes are placed in a jar, like the Novy jar, for example, the air in them may be easily replaced with hydrogen, while with the ordinary Petri dishes this is sometimes a difficult matter.

George C. Whipple.

Mt. Prospect Laboratory, Brooklyn, N. Y.

As a result of the investigations on malaria carried on in Italy by Professors Celli and Grassi, the Italian government will soon consider the appropriation of a sum of money to continue the work already begun. Employers of labor in malarial districts will be compelled to provide the proper precautions against infection, and also supply medical aid to laborers who contract the disease, at the same time providing a fixed amount for the support of their families when the employer fails to comply with the requirements of the bill.

LABORATORY PHOTOGRAPHY.

Devoted to methods and apparatus for converting an object into an illustration.

THE PROCESSES OF PHOTO-MICROGRAPHY.

In a previous paper, I described the apparatus employed in high-power photo-micrography and outlined the method used for the projection of the luminous image upon the focusing screen. To complete this description and to reduce the whole matter to a concrete example, I will here explain the further steps involved in the production of a negative, giving actual details of exposure time, speed of plate, etc.

Before proceeding to a discussion of processes, however, it will be well to consider the materials which are to be employed. Chief among these is the sensitive plate designed to receive the light impressions and to make permanent record of them. Formerly the old collodion wet plate was used for this purpose, and many of the best photo-micrographs ever made are the productions of the earlier workers who employed this process. Workers now-a-days, though, do not resort to the tedious methods the use of the wet plate involves, but choose the more convenient and rapid gelatin dry plate.

Of dry plates, there are any number on the market, and most of them are good for ordinary photography; but in photo-micrographic work the conditions are different from those which prevail where the image is smaller than the object and the light is plentiful. The strong diffusion of light involved in the production of an image 1000 diameters larger than the object itself renders it expedient to use plates that will record strongly all differences of lighting and thereby produce negatives with good "contrast." In this respect the slower plates, those of lower sensitometer numbers, are the best; and if the operator has any one with which he is familiar, he will do well to make use of it when undertaking the unfamiliar work of photo-micrography.

To such as are not adept in the manipulation of any particular plate, I would strongly recommend the orthochromatic "Carbutt Process Plate." After an extended trial of many plates, I find this one in a large degree satisfactory. It produces negatives with clear, sharp details and abundant contrast. The film is hard and firm, washes readily, and dries quickly. Beginners will make no mistake, I am sure, in starting with this plate. Since so many sections are stained by some one or other of the blue dyes, it is best to make use of the orthochromatic plates, as they give better balanced negatives. The "Process" plate may be obtained in this form and I prefer it to the plain form.

Next in importance to the plate is the developer with which the latent image upon it is made manifest. Here, as in the former case, I have nothing to recommend to those who are well acquainted with the action of any good developing fluid. The agent itself is really not of so much importance as is the knowledge of how to use it. By this, I do not mean that there is no choice, but it is better to manipulate a poor developer well than a good one poorly.

It is recognized that certain reducing agents, e. g., eikonogen, produce "thin"

negatives with much detail; while others, such as hydrochinone, afford density. Contrast being desirable, it is well to choose a developer containing a reducing agent that will best produce it. In doing this, however, it is often advantageous to combine reducing agents with opposing characters in order to secure a negative well balanced in detail and density.

If asked to recommend developers of this character I should suggest three that do the work well and, at the same time, differ otherwise so as to make them applicable under different conditions.

The simplest of these is known by the trade name "Rodinal." To prepare it for use, it is only necessary to dilute it with twenty parts of water. This, with its good keeping qualities, makes it convenient for those who have only an occasional negative to develop. Persons unfamiliar with its use will perhaps be startled at the suddeness with which the image flashes into view under its action, and will consider a normally exposed negative overtimed. It is, further, somewhat deceptive in the relative amount of density apparent before and after fixing, since the negatives produced by its use lose more under the action of the hypo than do almost any others. As it does not produce chemical fog, even after long action, it is well to let it operate until an apparent excessive density is produced.

Among the class of one-solution developers that may be prepared by the operator and kept for some time, I like the metol-hydrochinone mixture prepared after the following formula:

Water, distilled	500 c. c.
Metol	3 gm.
Hydrochinone	.5 "
Sodium Sulphite	18 "
Sodium Carbonate	14 "

Mix in the order given, and when wanted for use dilute with an equal quantity of water.

As a type of the two-solution developers, I would recommend the one given by Carbutt for use with his plates. This is prepared as follows:

Solution 1:

Water, distilled	600 c. c.
Sulphite of soda	120 gm.
Eikonogen	22 "
Hydrochinone	10 "
Add water to make	960 c. c.

Solution 2:

Water, distilled	600 c. c.
Carbonate of potash	60 gm.
Carbonate of soda	60 "
Add water to make	960 c. c.

To use, mix one part each of 1 and 2 with four parts of water.

Greater contrast can be obtained from any developer by decreasing the amount of alkaline solution or by the addition of a few drops of 10 per cent. potassium bromide solution.

The fixing bath, while by no means as important as the developing solution, may have its value underestimated. It is not uncommon to find operators who mix up water and hypo in almost any proportion and, without filtering the solution, use it until it becomes so discolored as to affect the film of the plate injuriously. A little care will greatly economise the use of the hypo and at the same time produce much better negatives. I find the following bath entirely satisfactory, cheap and convenient: Prepare and filter saturated aqueous solutions of hypo and boric acid. Mix one part of the hypo with three of the boric acid solution. This bath will keep until the hypo is exhausted without discoloring and, being acid, hardens the film.

Plate and developer are important agents in the production of a good negative, but, without the proper adjustment of light effect to the speed of the plate, they are worthless. The exposure must be judiciously regulated so that the darkest parts of the object will not be allowed to produce any effect upon the sensitive film, while, at the same time, the light must be allowed to act long enough to be effective, in various degrees, over the lighter portions of the object. General instructions regarding this part of the work are of little value, so I will outline the actual conditions under which negatives have been produced.

Source of illumination—the crater of an arc light placed at a distance of two feet from the object and having interposed between it and the condenser a ground glass disc. This disc stands about six inches from the crater and its matt surface is made somewhat transparent by rubbing with glycerin.

Condenser—a parachromatic of 1.30 N. A. in homogeneous contact with the lower portion of the slide. The diaphragm registers a numerical aperture of .5.

Object—a section of embryonic tissue 6⅔ micra thick, stained with iron-hæmatoxylin and mounted in balsam.

Objective—a 2 mm. homogeneous immersion apochromatic of 1.30 N. A.

Ocular—a No. 2 projection.

Magnification—1000 diameters.

Plate—a "Carbutt Ortho. Process."

Under these circumstances, an exposure of 20–30 seconds is sufficient.

Two things are to be guarded against during the time of exposure; viz., flickering of the light and vibration of the microscope or camera. Either of these untoward circumstances will ruin what might otherwise prove to be a good negative.

With the proper exposure and by the use of the metol-hydrochinone developer, the image will begin to appear upon the plate in about 30 seconds, and development will be complete in about five minutes. In the "Process" plate, very little of the image will show upon the reverse, or glass, side of the plate. The progress of the development is best observed by examining the image under transmitted light. Somewhat greater density than is finally desired should appear, since some of it is lost in the hypo.

Fix until all the unreduced silver salts are removed, and the shadows are clear. To be sure of this, allow the hypo to act some minutes after the last trace of milkiness has disappeared from the film.

Wash for an hour in running water and dry. With this plate, heat may be used to hasten the evaporation of the water from the gelatin.

The time limits here set are, of course, operative only under the conditions given. Increased light, either from greater transparency of the ground glass, enlarged aperture of substage diaphragm, or decreased magnification will materially shorten the time of exposure. It is possible, also to decrease considerably the exposure by employing a rapid plate instead of the slow one recommended. Some circumstances may justify this use, but ordinarily, the slow emulsion will give the better results.

Finally, one other suggestion may prove of advantage. Excessive contrasts may exist in the object itself, and it is desirable to reduce these. This may be accomplished by an over exposure producing a flat negative which may be made printable by subsequent intensification. This will give general detail even when the object is dark. Variations in density and detail, within more or less narrow limits, may also be secured by choosing printing papers of different kinds; this choice is particularly important when prints are made for micro-mechanical reproduction, since the balance of light and shade is not equally preserved by the various papers under these circumstances.

C. E. McClung.
University of Kansas.

A LABORATORY CAMERA STAND.

Photographic reproductions of material for illustrating Experiment Station and other literature have become important aids in technical work and have been used with more or less success—frequently the latter. The difficulty does not lie in the photographic processes, but rather in carrying them out. There are certain lines of work in which the photographic processes are not easily employed, such as illustrating microscopic insects and fungi. Even this field may be occupied in time. As long as botanists and entomologists depended upon the portrait photographer to prepare the negatives, the work was usually most disappointing; but with the advent of plant and insect photographers, some most excellent and pleasing results have been obtained.

In his little booklet on photographing trees and flowers, Mr. J. Horace McFarland has shown some things that may be done with simple apparatus. Before seeing this pamphlet an order was let for a laboratory stand that differs greatly from the one illustrated by Mr. McFarland, and also from the one used in the botanical laboratory of the Florida Agricultural College. The one at Clemson College is used for photographing diseased plants, individual plants, and similar material, with no idea of using it for illustrating bouquets or pot plants.

The source of light is from a high window to the north, making the illumination like a skylight.

The Stand.—The frame is made of one-inch angle-iron and holds the camera post and a 30 x 30-inch glass plate. At the lower end of the post is a mirror, attached by mechanical contrivances in such manner as to allow it to be raised or lowered; tilted forward, backward, or sidewise; brought nearer to the object or drawn back from it; or so adjusted as to throw the reflection off

entirely. With this arrangement any portion of the field may be illuminated, or the illumination may be dispensed with entirely.

Above the mirror attachment is the camera attachment, which allows the camera to be raised and lowered to any point on the post and securely clamped. The front board having been brought into position and the ground glass adjusted, the whole camera may be lowered or raised, or racked entirely out of the way until wanted.

ACCESSORIES.—Besides the camera and stand proper there are several accessories that are excellent time savers.

(1) A Four-Foot Rule, seen in the figure leaning against the camera frame. This rule has marked upon it the exact distance from the glass plate to the front board and to the ground glass for all combinations needed. Thus, by using a Zeiss 8 x 10 series V lens, to enlarge the object two diameters the front board should be 10½ inches from the glass plate and the ground glass 30½ inches; for making a ⅝ natural size negative the front board should be 18 inches and the ground glass 29 inches, and so on, for other enlargements and reductions. The advantage of this rule is that the camera is adjusted quickly and accurately without experimenting. When the specimen is in place the camera may be racked to such position as to bring the highest part of the object (that nearest the lens) into sharpest focus. Those who do not use a rule of this kind will find it a surprising convenience. If the stand is of a different design it is sometimes practicable to mark these distances upon the post to serve the same purpose.

(2) A Ruled Card is prepared from a piece of heavy cardboard 30 x 30 inches, the size of the glass plate, and ruled so as to have areas corresponding to multiples of different sized plates. Where a large number of plates are used, the cost becomes an item worth considering, and there is no occasion for using an 8 x 10 plate if 6½ x 8½ or 5 x 7 will answer. The areas for the 4 x 5 and 8 x 10 plates are 30 x 24, 25 x 20, 20 x 16, 15 x12, 10 x 8, 5 x 4, and 2½ x 2. The reverse side of the card is ruled for the 5 x 7 and 6½ x 8½ plates. These two sizes do not coincide as is the case with the 4 x 5 and 8 x 10, so a dotted line is used for the 6½ x 8½ fields and a line for the 5 x 7.

This ruled card serves two purposes: (1) The object is placed upon it to ascer-

tain what sized plate will cover it with the least waste. It also shows at a glance how much the object will be reduced or enlarged for that particular plate, and by reading the rule the camera may be adjusted at once. (2) The card being placed *under* the glass plate shows the exact field that the object should occupy to be included on the ground glass.

(3) A Glass Plate. A method for posing insects, and one equally serviceable for arranging flowers, is to secure a clean glass plate, such as the glass from a photographic plate or other equally good sheet of glass of the desired size. The object is arranged upon this glass and when properly posed is slipped into position under the lens. The glass being clean, the plate of the stand likewise, and both free from defects, no image of either will be formed on the sensitive plate. This method was developed by Prof. A. L. Quaintance while associated with the writer.

(4) A Paper Rule such as is sold by the Cambridge Botanical Supply Company, with sharp lines upon clear white paper, a little heavier than heavy herbarium paper, makes a convenient object to focus upon. Such a rule is so light that it may be placed upon the object to be photographed for the purpose of verifying the focus before inserting the plate-holder. In many cases the rule may be left in an appropriate portion of the field to serve as an index of the enlargement or reduction. In the absence of a light paper rule, a visiting card, as Mr. McFarland suggests, makes a convenient object to prove the focus. A wooden rule is anything but a desirable substitute.

In conclusion I would recommend heavier angle-iron for the frame, say about 2½ or 3 inches. The one-inch makes a frame appear light and the post not so firm as might be desired. In practice it has given no trouble.

A suitable background is supplied in the same way as suggested in the booklet referred to before.

P. H. Rolfs, Botanist.

Clemson Agricultural College, Clemson College, S. C.

Received for Notice.

Modern Photography in Theory and Practice. H. S. Abbott, Chicago; Geo. K. Hazlett & Co. Cloth, 230 pp.

This book is, as its title page states, "A Hand Book for Amateurs," containing chapters on the principal forms of cameras and apparatus likely to be used by the amateur, methods of loading plate-holders, recording exposures, focusing, exposing, development, and the various processes in the manipulation of the negative, paper, etc., to produce a satisfactory print. Standard formulæ for the various solutions are freely quoted, and numerous illustrations show the principal kinds of paper for making prints.

The book is intended for the studious amateur, and as a repository of useful formulæ and hints for the beginner it serves its purpose admirably.

L. B. E.

Journal of
Applied Microscopy
and
Laboratory Methods.

Edited by L. B. ELLIOTT.

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The majority of our subscribers dislike to have their files broken in case they fail to remit at the expiration of their paid subscription. We therefore assume that no interruption in the series is desired, unless notice to discontinue is sent.

OWING to extreme pressure of work in connection with his new courses, at the University of Pennsylvania, Dr. R. M. Pierce will not be able to review the literature of "Normal and Pathological Histology" as heretofore. The work which Dr. Pierce has done for the JOURNAL in this department has been greatly appreciated by our readers. We are fortunate in securing the coöperation of Dr. J. H. Pratt, Harvard University Medical School, to continue the work. Dr. Pratt will conduct the department along the lines heretofore followed.

* * *

The interest expressed by our readers in Zoölogical methods, both in the laboratory and in the field, has made it necessary to add to our reviews a department of "Current Zoölogical Literature." In this department will be included reviews of important zoölogical investigations, especially those which deal with types most frequently used in laboratory work; methods in use in zoölogical laboratories and by zoölogical investigators in the preservation and preparation of animal forms for microscopical examination, for dissection and for exhibition purposes; methods in field work in zoölogy, apparatus for collecting aquatic and marine life, and suggestions for maintaining aquaria and vivaria in the laboratory; notes on methods in vogue at fresh water and marine biological stations. The fact that Mr. C. A. Kofoid, University of California, will conduct this department, is in itself a guarantee of the practical nature of the matter, which will be selected from the mass of American and foreign literature on the subject, and of the faithful rendering of the author's meaning. Separates of papers or books for review should be sent addressed to C. A. Kofoid, University of California, Berkeley, Cal. Authors will confer a favor by sending separates as soon as issued, in order that our reviews may be as little delayed as possible.

* * *

Now that we are on time in publication once more, notes and news items from the various laboratories will be welcomed, and we ask those in need of assistance to make use of the question-box. Inquiries will be answered through the JOURNAL, or, if in pressing need of information, at once by letter.

* * *

Numerous requests for an exchange department for the exchange or sale of books, material, and apparatus, have reached the editor from time to time. We do not consider the conduct of such a department advisable, as we are not in position to know the responsibility of every sender of an exchange notice, or of the merits of the article offered.

CURRENT BOTANICAL LITERATURE.

CHARLES J. CHAMBERLAIN.

Books for review and separates of papers on botanical subjects should be sent to Charles J. Chamberlain, University of Chicago, Chicago, Ill.

REVIEWS.

Dixon, H. H. On the first mitosis of the spore-mother-cells of Lilium. Notes from the Botanical School of Trinity College, Dublin, No. 4, pp. 129–139, pls. 7–8, Jan., 1901.

In reviewing the literature of this subject Prof. Dixon finds that, while there is a wide divergence of opinion in regard to the phenomena involved in this mitosis, there are, nevertheless, certain stages which are admitted and which have been constantly observed. How these stages are derived from one another is the most debated question. The writer figures and describes six well ascertained stages and then proceeds into the debated territory. Nearly all observers describe a longitudinal splitting of the entire thread just previous to the segmentation into chromosomes, but Prof. Dixon believes that the stage so constantly observed arises from the looping on each other and approximation of two portions of the thread. Several very suggestive objections are urged against the commonly accepted interpretation. While believing that each of the two twisted portions undergoes a longitudinal splitting while still in the spirem stage or immediately after differentiation into chromosomes, regarded as a *second* longitudinal splitting by Guignard and others, the author believes that this is the first and only longitudinal splitting.

A series of very clear diagrams illustrates the writer's interpretation of the composition of the chromosomes and their behavior during the later phases of mitosis. According to this interpretation there is no differential or "reducing" division during the first mitosis of the spore-mother-cell. C. J. C.

Britton, Elizabeth G., and Taylor, Alexandria. Life History of Schizea pusilla Bull. Torrey Bot. Club, **28**: 1–19, pls. 1–6, 1901.

This is the first fairly complete account of the life history of this interesting fern. The material was collected at Forked River, New Jersey, in July, 1900. Sections do not seem to have been made except in the study of the root, stem and leaf. While the peculiar gametophyte and general aspect of the young sporophyte is shown more clearly without sections, we cannot help feeling that the development of antheridia and archegonia and also the very young sporophyte would have been more satisfactory if the study had been made from microtome sections.

A part of the description, which could hardly be abbreviated, reads as follows: "The gametophyte is composed of numerous, erect, branching, dark green protonemal filaments; monœcious, bearing 5–12 archegonia, usually on a slightly thickened and expanded series of cells in the nature of an archegoniophore (?) or directly on the filaments; antheridia more numerous, often on separate branches and nearer the extremities of the filaments; radicles seldom borne on the filament, but produced from specially modified, large spherical cells, appar-

ently in symbiotic relation with a fungus." The filamentous prothallium persists until the young sporophytes have attained considerable size.

In the development of the antheridium, one figure shows a filament of three cells. The outermost cell "becomes large and globular and cuts off a cap cell at the summit, with the wall oblique; the large cell divides into the mother cells of the antherozoids and one ring cell."

The archegonia are not at all imbedded, but are entirely free, and, at first glance, bear a striking resemblance to the archegonia of certain liverworts. Each archegonium is derived from a single superficial cell which divides into three cells. The basal cell forms the venter and from the middle cell arises the central cell and the canal cell. The other cell forms the neck.

The anatomy of the root, stem and leaf is described in considerable detail. The six plates of careful drawings form no small part of the contribution.

C. J. C.

Macallum, A. B. On the Cytology of Non-nucleated organisms University of Toronto Studies. Physiological Series, No. 2, 1900.

This work was undertaken with the hope of throwing some light on the origin of the cell nucleus and to obtain data to determine the morphological character of the primal life organism. The work is divided into three parts, each dealing with a separate group of low organisms, namely, the Cyanophyceæ, Beggiatoa, and the yeast cell.

His results on the Cyanophyceæ are briefly as follows: The cell consists of two portions, the central body and the peripheral zone holding the pigment. There is no evidence of the presence of a special chromatophore. There are two types of granules present in the cell. The one stains with hæmatoxylin, contains "marked" iron and organic phosphorus, and therefore resembles chromatin. The other type is found in the peripheral layer, and chiefly adjacent to the cell membrane. It stains with picro-carmin, and is free from organic phosphorus and "marked" iron. It is probably a proteid. There is no nucleus, nor any structure which resembles a nucleus in the Cyanophyceæ.

In Beggiatoa there is no differentiation of the cytoplasm into a central body and a peripheral layer such as Bütschli describes. The compound of "marked" iron and organic phosphorus are uniformly diffused throughout the cytoplasm in the threads. In the "spirilla," "comma" and "cocci" forms the cytoplasm shows characters like those of the threads, but there are also granules present which give slight reaction for "marked" iron and organic phosphorus and therefore is considered analogous to chromatin. No specialized chromatin-holding structure in the shape of a nucleus was found in any of the forms of Beggiatoa studied.

In his studies on the yeast cell Macallum finds the cytoplasm takes a diffuse stain with hæmatoxylin and gives a diffuse reaction for "marked" iron and organic phosphorus. In addition to the chromatin-like substance diffused throughout the cell, there is usually present a homogeneous corpuscle. This is not considered to be a nucleus although held as such by other investigators. The chromatin-like substance in Saccharomyces is soluble in artificial gastric juice, thus differing from the chromatin of the higher animal and plant cells.

In his investigations Macallum used the ordinary cytological methods and

also micro-chemical reactions. Many fixing fluids were employed, but the best results were obtained with picric acid and corrosive sublimate. The staining reagents employed were Ehrlich's and Delafield's hæmatoxylin, Czokor's alum, cochineal, safranin, eosin, picro-carmin and methylen blue. Picro-carmin was employed to stain the cyanophycin granules. A strong solution of hydrogen peroxide containing traces of sulphuric acid was used to liberate the "marked" iron.

The paper is a most valuable addition to the literature of this important problem. A. A. LAWSON.

Chicago.

Pierce, G. J. The nature of the association of Alga and Fungus in Lichens. Proc. Calif. Acad. Sci. Ser. III, **1**: 207–240, pl. 41, 1899.

Both cultures and microtome sections were used in this work. Various fixing agents were used, but a saturated solution of corrosive sublimate in 35 per cent. alcohol just below the boiling point proved most satisfactory. Dehydration must be thorough, but, on account of the gelatinous coating of the lichen, must not be too rapid.

The results show that the hyphæ and gonidia are in the most intimate connection, the hyphæ developing branches which clasp the algal cell or even enter it as haustoria. This relation stimulates the algal cell to internal cell divisions. The haustoria drain the living contents of the algal cells, leaving only the empty cell walls. The fungus is fed by the alga and it is doubtful whether the alga receives any benefit, since it is known that in their resting forms free algæ withstand extremes of heat, dryness, etc., as successfully as do the algæ which are associated with fungi in lichens. C. J. C.

CYTOLOGY, EMBRYOLOGY, AND MICROSCOPICAL METHODS.

AGNES M. CLAYPOLE.

Separates of papers and books on animal biology should be sent for review to
Agnes M. Claypole, Sage College,
Ithaca, N. Y.

CURRENT LITERATURE.

Beard, J. The Source of Leucocytes and the True Function of the Thymus. Anat. Anz. **18**: 550–573, 1900.

The function of this obscure gland has been hitherto but little known. Its origin from the epithelium of the gill pouch by Koelliker for mammals, and his subsequent statement that the original epithelial cells gave rise to leucocytes, has been followed by two views: one that these leucocytes have migrated into the gland from outside, the other that they originated within the gland. A complete developmental study of *Scyllium canicula* made by the author disclosed the fact that for a relatively long period the blood contains only nucleated red corpuscles, no leucocytes of any kind being present, as had been noted by Koelliker some years before. In these studies investigation was carried on in two lines. First, a careful search was

made for the stages in which leucocytes first appeared in the blood and mesoblast. Second, the development of the thymus was followed from its earliest stages till the permanent characters appeared. The best material was found to be that fixed in Rabl's picro-platino-chloride, or in corrosive sublimate. The most satisfactory stain is picro-carmin. In this stain the red blood corpuscles are yellow and the nuclei often unstained (in picric acid preparations); the leucocytes are differentially stained, nuclei a brilliant red and their scanty protoplasm a yellowish-brown. All the sections were of embryos less than 30 mm. in length and have been studied with the Zeiss 2 mm. apochromatic and a Leitz $\frac{1}{12}$ oil immersion.

The origin of the thymus element is from a small area of modified epithelium. The term "placode" will be used for this thymus element, a name introduced by von Kupper for such a small piece of modified epithelium. The thymus elements arise in the skate as specialized portions of the epithelium of the gill pouches before these open to the outside, and hence the thymus is of hypoblastic origin. These placodes are five in number on each side. In most cases the histogenesis of the thymus does not take place until the embryo is 17–18 mm. long, leucocytes appearing at the same time. It is evident that the first of these originate in the thymus epithelium, and until some are found there none are present elsewhere in the mesoderm or blood. The first changes seen in the transition of the epithelial cell into a leucocyte is an increase in the refractive power of the cytoplasm and under favorable conditions it assumes a somewhat brownish color. Gradually the nucleus changes from its oval shape and becomes rounder, a form later assumed by the whole cell. Finally the nucleus comes to its eccentric position. Many of these newly formed leucocytes wander out immediately into the tissue, while others remain in the gland and increase by division, as is shown by their being in groups of 2 and 4. Emigration of leucocytes begins at first singly, but later the even contour of the gland is broken, one break occupies nearly the whole lower surface, and here the leucocytes are wandering out en masse. Many are here in the blood itself. These breaks in the placode walls are very characteristic, all the thymus elements of all the embryos from this stage up to those 42 mm. in length.

The thymus of an embryo of 71 mm. has practically reached its adult condition. The corpuscles of Hassall have never been seen, in the embryo, young skate or adult. Their presence in fishes is uncertain, only one author mentions finding them. The transition from the epithelial structure is as follows: In an embryo of 33 mm. the epithelial cells are restricted to the basal portion of each placode; the emigration of leucocytes is in active progress; no blood vessels are as yet within the thymus and it is without a connective tissue capsule. No spleen has yet been formed. In an embryo of 43 mm. a capsule is in process of formation, but no blood vessels have formed. Connective tissues strands are forcing their way in and lobulating the organ. In an embryo of 71 mm. the thymus elements are free from the epithelium of the clefts, separated by the capsule growth; this latter still permits the emigration of leucocytes, and there are many such within the organ. Blood capillaries are now within the organ, brought there by the connective tissue, and afford easy transport for the leucocytes.

The author considers that there is no other source of leucocytes in the vertebrate body for several reasons. 1. The first leucocytes clearly rise from the thymus, as there are no others present in the body when this organ first forms such structures. These first or parent leucocytes quickly infiltrate the blood, and other lymphoid tissues rise in all probability from such migrating cells. 2. No other lymph organ is known which resembles the thymus in origin and developmental history. 3. The thymus alone is sufficient to account for all the leucocytes of the body and it is an organ characteristic of all true vertebrates. 4. Except in the case of paired or metameric organs it is not usual to find the same function in any two organs of the body. The thymus is a paired metameric structure of the branchial region only. That the thymus should be the parent source of leucocytes explains its functional activity in young animals and its later atrophy.

A. M. C.

Folsom, J. W. The Development of the Mouth Parts of *Anurida maritima*, Guér. Bull. of the Museum of Comparat. Zoöl., Harvard College, **36**: 87–157, 8 pls., 1900.

The object of the paper was twofold, to supplement a previous account of the anatomy and functions of the mouth-parts of a representative collembolan and to discuss the morphology of mandibulate mouth-parts of insects and their nearest allies upon anatomical and embryological evidence derived from the most primitive insects, the Apterygota. Material was killed in hot water and carried through successive stages of alcohol to be preserved in absolute alcohol. Material was imbedded in hard paraffin and sections cut from 5–10 μ in thickness. Delafield's or Kleinenburg's hæmatoxylin followed by safranin, Grenacher's alcoholic borax-carmin, and Heidenhain's iron-hæmatoxylin were used for staining.

Nine consecutive stages were taken for representing the development stages, and the following parts are considered: The procephalic lobes, labrum and clypeus, antennæ, premandibular appendages (intercalary), mandibles, lingua and superlinguæ, maxillæ, labium, skull, tentorium, segmentation of the head.

The proto cerebrum of the Apterygota agrees with that of other insects in development and structure. The ocular segments of the Hexapoda and decapod Crustacea, as well as the compound eyes of the two groups, are homologous. The labrum and clypeus of insects develop from a single median evagination between the procephalic lobes, and do not represent a pair of appendages. The labrum of Apterygota is homologous with that of other insects, and of the Symphyla, Diplopoda, Chilopoda, and higher Crustacea. The antennæ of the Apterygota evaginate from the posterior boundaries of the procephalic lobes, and agree with those of the Pterygota. In both groups the antennæ are first post- and later pre-oral in position. The dentocerebrum of insects is homologous with that of Crustacea, and the antennæ of Hexapoda are equivalent to the antennules of Crustacea, and the embryonic pre-antennæ of Chilopoda. Premandibular or intercellary appendages exist in the embryo of Anurida, and appear to be represented in the adults of several Apterygota genera. The tritocerebrum of Apterygota is homologous with that of Orthoptera and decapod Crustacea, and the rudimentary premandibular appendages of Collembola and Thysanura represent the second antennæ of decapod Crustacea, and probably the antennæ of Diplopoda and Chilopoda. A distinct ganglion for the intercalary

segment shows it to be a primary head segment. The mandibles develop from simple papillæ, and are only lobed in Campodea; they are homologous with the mandibles of Pterygota, Scolopendrella, Crustacea, and probably Diplopoda and Chilopoda. The hypopharynx consists of two dorsal "superlinguæ," developing from a pair of papillæ between the mandibular and first maxillary segments, also a ventral lingua. First maxillæ develop as in Orthoptera. A palpus appears in the embryo, which disappears before hatching. The labrum of Anurida develops from a pair of papillæ from which the entire gular region is derived. A palpus appears, but is resolved. It is homologous with the Pterygota structure, agrees in detail with the first maxillipeds of decapod Crustacea. The sides of the face develope from a lateral evagination near the mandibular segment, which eventually involve the labral and labial fundaments. These folds are of Collembola, Campodea, and Japyx, are homologous with the genæ of Pterygota. The dorsal region of the skull in Anurida does not differentiate into sclerites comparable with those of the Pterygota. The evidence is for seven segments in the head, as is probably true for all Hexapods. Ocular, antennal, intercalary, mandibular, superlingual, maxillary, labial, with ganglia, and a pair of appendages for each. The Collembola resemble Campodea and Japyx in structure, their entognathous characteristics separating these groups from the rest of these insects. The Collembola are somewhat more specialized than the Thysanura in general structure. The Aphoruridæ, including Anurida, are the more generalized and probably degenerate forms. The resemblance in most parts indicates that the primitive collembolan descended from the stem form of Campodea, the affinities of Campodea, and in two directions, towards Machilis and Lepisma, and towards Scolopendrella. A. M. C.

Kizer, E. J. Formalin as a Reagent in Blood Studies. Proceed. Indiana Acad. of Sci., p. 222–2, 1898.

This has been found a useful reagent in bringing out blood structures. It produces no visible distortion, does not interfere with staining, and is an excellent preservative. One volume of fresh blood is mixed with three volumes of two per cent. formalin, and after standing for an hour a drop is pipetted from the sediment to a cover slip, and allowed to dry by evaporation after being spread evenly. Slips are fixed in a flame, and dipped once or twice in a five per cent. solution of acetic acid. The acid is removed by water, and two per cent. gentian-violet is used, or methyl-blue and gentian-violet, or hæmatoxylin and eosin, methyl-green and safranin, or Ehrlich's triple stain. Excess of stain is removed by water or alcohol, as the fluid requires. Mounted in balsam. A. M. C.

Baum, J. Beiträge zur Kenntniss der Muskelspindeln. Anat. Hefte. H. 42, 43, 249–306, 4 Tafler, 1900.

The author used the muscles of man and other mammals (especially the hedgehog, guinea pig, dog, cat, rabbit sheep, pig, mole) also of *Pristiurus melanostomus*, *Syngnathus phlegon*, Petromyzon, and the frog. The muscle was studied fresh; it was isolated in concentrated caustic potash, which does not affect the nuclei and fibres, but loosens the connective tissue, so that in fifteen minutes separation is easy, but great pressure on the cover-glass must be avoided. Acetic acid is used for isolation

since the nerve fibres are rendered very easily distinguishable. For nerve endings the gold stain of Löwit was used. Müller's fluid, and occasionally sublimate, were the best fixatives. Embryonic and small animals were decalcified with picric or hydrochloric acid. Imbedding was sometimes in collodion and sometimes in paraffin. Staining was mostly in hæmatoxylin and eosin. Both bulk and section staining were used. A. M. C.

Smith, S. Note on Staining of Sections while Imbedded in Paraffin. Jour. of Anat. a. Physiol. **31**: 151–152, 1900.

The author leaves the sections stretched on warm water to which the staining solution has been added. Subsequent washing in clear water was followed by treatment in the usual manner.

A. M. C.

CURRENT ZOÖLOGICAL LITERATURE.

CHARLES A. KOFOID.

Books and separates of papers on zoölogical subjects should be sent for review to Charles A. Kofoid, University of California, Berkeley, California.

Schönichen, W., und Kalberlah, A. B. Eyferth's Einfachste Lebensformen des Tier- und Pflanzenreiches. Naturgeschichte der Mikroskopischen Süsswasserbewohner. 516 pp., 16 Taf., Braunschweig, 1900. Verlag von Benno Goeritz.

A third fully revised and enlarged edition of Eyferth's treatise on the fresh water micro-fauna and flora has been prepared by Drs. Schönichen and Kalberlah, assistants in the Royal Botanical Gardens at Halle, Germany. The present work is a very decided advance upon previous editions, the revision having been most thorough and painstaking. The authors have endeavored to include only those forms which are most common and most widely distributed. Many genera and species described in recent years have been added in this edition. The cosmopolitan character of the organisms found in fresh water makes a treatise of this nature useful everywhere, quite as much in America as in Europe. The scope of the book is indicated in the title. The groups included are the bacteria, algæ, desmids and diatoms, the protozoa and the rotifers. The main body of the text is made up of brief diagnostic descriptions with synoptic keys to the various divisions down to species, over 600 of which are figured on the plates. The specific descriptions are necessarily very brief. The book is thus not for the use of the specialist, but is intended for the general student, and the amateur microscopist. It is a very convenient manual for the biological laboratory. C. A. K.

Keibel, F., und Abraham, K. Normentafel zur Entwicklungsgeschichte des Huhnes (Gallus domesticus). 132 pp., 3 pls., 4to. Jena, 1900. Verlag von Gustav Fischer.

The second number of Keibel's "Normentafeln" of the development of the vertebrates has been written by the editor-in-chief of the series, with the assistance of one of his students. The growth of the chick embryo has been systematically traced from the earliest stages, through the first ten days of incubation. Carefully drawn figures are given of a series of embryos viewed, how-

ever, only as opaque objects. A tabular view is given of the stage of development of the various organs of the body in 132 embryos of successive ages up to ten days. The authors call attention to those features of the development which are subject to individual variation in the chick. The care with which this work has been done makes this book a valuable work of reference in establishing the age of embryos as well as in the selection of embryos for the study of organology. The book is an indispensable aid in every embryological laboratory. A very full bibliography of the subject occupies fifty quarto pages of the book.

The fixing agents used were sublimate-acetic and chrom-acetic, and the stains borax-carmin (followed in some cases by bleu de Lyon), para-carmin, and hæmatein. C. A. K.

Linko, Alex. Ueber den Bau der Augen bei den Hydromedusen. Mem. de l'Acad. imp. des Sci. St. Petersbourg. Cl. Phys. Math. **10**: No. 3, 1–23, pls. 1–2, 1900.

Material was prepared with aceto-sublimate, Perenyi's fluid, etc., and stained with Delafield's hæmatoxylin or alum or borax-carmin. All attempts to use methylen-blue or the Golgi method in any of their modifications were futile. The depigmentation of the eyes was effected neither by Grenacher's method, by chlorin, nor by eau de Javelle. In some species the pigment was partially removed by exposure to Perenyi's fluid for 3–4 hours, though this induced some maceration of the tissues. Eight genera were examined, exhibiting a wide range in structure. In *Catablema* the eye is a simple pigment fleck, composed of pigmented and of visual cells. In *Oceania* a pigmented area of similar structure is found in a shallow pit. In *Staurostoma* the eyes are numerous (400) and vary from a simple pigment spot to the beaker-form eye with vitreous body. In *Codonium* the sensory cells are somewhat retracted and their outer ends exhibit thickenings which terminate in sensory "hairs." In *Sarsia* a vitreous body occurs and the sensory cells terminate in conical end organs. *Sarsia* is quite sensitive to the stimulus of light. The eyes of *Tiaropsis* are of the inverted type with pigment cells of entodermal origin. C. A. K.

Bergh, R. S. Beiträge zur Vergleichende Histologie II. Ueber den Bau der Gefässe bei den Anneliden. Anat. Hefte **15**: 599–623, pls. 48–51, 1900.

Various writers have stated that the blood vessels of Annelids are provided with a layer of longitudinal, and one of circular muscle-fibers, with a lining of connective tissue intima, folds of which form the valves. Others have reported that the blood vessels have an endothelial lining. Bergh has found a number of errors in these statements. *Lumbricus* was cut open and pinned out with porcupine spines in silver nitrate. The silver was reduced by exposure to sunlight or in alcohol slightly acidulated with formic acid. The mixture of formic acid with the silver solution directly produced too excessive blackening and precipitation. Silver preparations were stained in hæmatoxylin. Blood vessels for sectioning were freed of their blood by slight pressure before fixing in aceto-sublimate. Sections were stained in hæmatoxylin or by van Gieson–Hansen's hæmatoxylin-acid fuchsin-picric method, which leaves the muscle fibers yellow, and the connective tissue ground substance a bright red. Bergh was not able to find an endothelial lining in any of the blood vessels, neither could he detect any longi-

tudinal muscle fibers. The valves are not folds of the intima, but are composed of masses of cells. The blood vessels, contractile and non-contractile alike, are lined throughout by a homogeneous non-cellular connective tissue membrane (Leydig's intima), which is sharply limited internally and externally. Outside of the intima is a layer of connective tissue cells which, in the non-contractile vessels contains fibrous or band-like elements in circular arrangement. In contractile vessels this connective tissue layer contains strong circular muscle fibers with characteristic nuclei. Free blood vessels are covered by the peritoneal cells, which have various forms. The formed elements of the connective tissue layer in silver preparations exhibit endothelial-like boundaries, and adherent blood cells in the vessels resemble endothelial nuclei, hence the endothelium reported by previous authors. C. A. K.

Ritter, W. E., and Crocker, G. R. Multiplication of the Rays and Bilateral Symmetry in the 20-Rayed Starfish, *Pycnopodia helianthoides* (Stimpson). Proc. Wash. Acad. Sci. **2**: 247–274, pls. 13, 14, 1900.

Young stars of this species were found having from six to sixteen arms in all stages of growth. The six arms are arranged in a group of five and a single one, the budding zones being placed between the two and the younger arms coming in simultaneously on each side of the group of five. The stars are thus bilateral, but the madreporite is not a median organ. The arms arise as interradial outgrowths of the water-vascular ring-canal and the perihæmal canals, forming ambulacra and receiving radial nerves, which at first project into an ectodermal pocket from the outer edge of the nerve ring. A comparison is made of the position of the sixth arm and that of the larval organ (preoral lobe) of *Asterina*. C. A. K.

NORMAL AND PATHOLOGICAL HISTOLOGY.

JOSEPH H. PRATT.

Harvard University Medical School, Boston, Mass., to whom all books and papers on these subjects should be sent for review.

Melnikow-Raswedenkow. Pachymeningitis Hæmorrhagica Interna. Ziegler's Beiträge, **28**: 217, 1900.

In his study of the normal structure of the dura, the author found Weigert's elastic tissue stain of great value. In the inner portion of the dura the following layers can be distinguished: (1) A single layer of epithelium which covers the inner surface; (2) a hyaloid, fenestrated, elastic membrane, which varies with age and with the individual; (3) the inner capillary network; (4) a layer of connective tissue, mixed with elastic fibers. The dura mater is a peculiar formation and has nothing in common with the plural and peritoneal serosæ.

Internal pachymeningitis is regarded as an inflammation. A fibrinous exudation occurs upon the surface of the internal elastic membrane. Organization of the exudate follows; thin-walled capillaries grow out from the capillary layer and pass through spaces in the internal elastic membrane. Rupture of the newly formed blood vessels is common and hæmorrhage into the delicate connective tissue results. J. H. P.

Hauck, L. Untersuchungen zur Normalen und Pathologischen Histologie der Quergestreiften Musculatur. Deutsche Zeitschr. f. Nervenheilk., **17**: 57, 1900.

Hauck found, in agreement with other observers, that in infants the individual fibers of different striated muscles have practically the same diameter, while in adults fibers from different muscles vary greatly in diameter. The thickness of the fiber is dependent upon the general nutrition of the individual. Rigor mortis causes a decrease in the diameter.

In a series of experiments upon young dogs the author studied the influence of rest, work and enervation upon the size of the muscular fibers. Cutting the sciatic nerve produces simple atrophy of the muscle supplied by it. The width of the muscular fibers is diminished about one-half. Simple muscular inactivity due to ankylosis gives the same result. J. H. P.

Moser, A. Tuberculosis of the Heart. Med. and Surgical Reports of the Boston City Hospital, **II**: 194, 1900.

Moser reports a case of tuberculosis of the myocardium, and presents an analysis of forty-five other cases collected from the literature. In the case studied by the author, a firm yellow thrombus, two cm. in size, was found attached to the wall of the left ventricle. The heart muscle was yellow and fibrous. Histological examination showed that the muscle underlying the thrombus was tuberculous, and that tuberculous tissue was growing into the thrombus. The process apparently began with the formation of subendocardial tubercles, which later fused together. Tubercle bacilli were found in over half of the sections examined.

Moser states that the following method of staining tubercle bacilli in sections, devised by Mallory and Wright, is superior to the common method known as the Ziehl-Neelsen: Stain lightly in alum hæmatoxylin; then in steaming carbol-fuchsin two to three minutes; decolorize in one per cent. acid alcohol one-half minute; wash thoroughly in water; dehydrate in alcohol; clear in xylol and mount.

Birch-Hirschfeld, in reporting a similar case of tuberculous mural thrombus of the heart, gave two possible modes of origin: (1) Bacilli wandered into a mural thrombus, or (2) bacilli clung to the heart wall, grew, and formed a thrombus. The latter view was regarded as the more probable, as Ribbert produced endocarditis by injecting into the circulation particles of potato laden with micrococci. J. H. P.

Fujinami. Ueber das Histologische Verhalten des Quergestreiften Muskels an der Grenze bösartiger Geschwülste. Virchow's Archiv., **161**: 115, 1900.

Fujinami studied a large number of cases and found that both cancers and sarcomas invade muscle in much the same way. They may infiltrate between the separate muscle fibers; they may press against the muscle fibers as a mass; or they may be separated from the muscle fibers by bands of connective tissue, thus only affecting them indirectly.

The infiltration by the tumor takes place through the sarcolemma sacs, as well as through the tissue spaces, and through the lymph and blood vessels. The invasion of the sarcolemma sac is especially marked when the infiltration of the muscle is parallel to the muscle fibers, and is much more common in cancers

than in sarcomas. In fact, the round-celled type is the only form of sarcoma in which the invasion of the sarcolemma sac has been observed.

A variety of changes occurs in the muscle fibers as a result of the presence of the neoplasm. Simple atrophy is the most frequent. Usually the muscle nuclei disappear as the muscle fibers atrophy. Sometimes, however, the nuclei increase greatly in number. Multiplication occurs chiefly, if not entirely, by direct division. The nuclei may be found in masses, which may be mistaken for giant cells.

The tumor cells may compress muscle fibers, giving rise to an irregular atrophy, which causes the fibers to assume a beaded appearance.

All the changes which occur in regenerating muscle and which have been regarded as regenerative processes are found in the degenerating muscle. Hence, it is impossible to tell by histological examination alone whether regeneration or degeneration is in progress. J. H. P.

Benedict, Dr. A. L., Buffalo. Clinical Quantitative Analysis of Proteids in Stomach Contents.

In the examination of stomach contents, thus far, the real function of the stomach, and how well or how poorly that function is performed, has not been ascertained. It has been learned how much hydrochloric acid remained in excess of that taken up by food; whether a similar excess of ferments was present; how much the stomach had interfered with starch digestion, and when the stomach passed its contents into the small intestine; but the direct issue of the amount of albumin transformed into albumoses and true peptones has been ignored.

The method consists in the successive precipitation of the proteids in solution in the stomach contents and their approximate measurement by centrifugalizing the three precipitates, acid albumin, albumoses and peptones. At first thought, this would seem to be a very simple matter, but I assure you that to place it on a practical clinical basis required a large amount of research and laboratory experiment, as well as interviews and correspondence with chemists. Strangely enough, no analytic chemist seems to have undertaken the problem before. Any physiological chemistry contains directions regarding the reactions of the various forms of nitrogenous matter, but, in practically every case, it was assumed that an unlimited supply, usually prepared artificially, was available. In all instances, the tests were given with the understanding that the investigator would perform them as a matter of scientific curiosity and not with the practical, analytic object of separating and quantitating the ingredients of a mixed mass of proteids. For several years, it has been my custom to take up some special problem, either in physical diagnosis, applied chemistry of digestion, microscopical technic, or some other theoretic topic that seemed likely to yield practical results if properly applied, and to make a winter's study of it. But the problem of proteid digestion in the stomach has occupied two winters, simply because my ignorance of certain scientific details of chemistry compelled me to grope in the dark; while, on the other hand, lack of familiarity with the conditions of medical practice prevented chemists from giving me exactly the information which would have been of the greatest use. I mention this point

only to urge a more general co-operation between the medical scientist and the medical practitioner, in attacking the many problems that lie before us, the solution of which will make medicine more and more an applied science, as well as an art.

One of the difficulties in the way of careful analysis of chyme is the small amount obtainable — not usually over eighty and often less than thirty cubic centimeters, after the ordinary test meals. Free HCl and total acidity can be estimated at one titration, if we are careful and meet with no mishap. Combined acidity requires another titration, proteids another, and at least a small quantity must be reserved for various qualitative tests. While the tests for acidity are best applied to unfiltered chyme, proteolysis requires a clear filtrate, and a considerable loss occurs on account of the mass left on the filter. As a matter of practical experience, I have found that the tests for proteids must be made with ten or sometimes only five cubic centimeters. Filtration, especially if much mucus is present in the stomach contents, is a tedious process. I have tried all sorts of expedients, such as the use of absorbent cotton, separation by a colander, etc., but have not succeeded as yet in obtaining rapid filtration. By centrifugalizing the stomach contents, they can readily be separated into three layers, the lower one consisting of undigested food, the upper one of butter and mucus, the middle one of comparatively clear liquid. By removing the upper layer, the middle one can be decanted and filtered in the usual way, without the delay required if the stomach contents are simply poured into the filter.

There is no natural separation of the various steps of the peptonizing process, but, by common consent, chemists consider that every proteid not precipitated by ammonium sulphate in saturated solution is a peptone, and that everything between albumin and peptone may be called albumose. Of course, the process of peptonization could be further subdivided by using different reagents. To precipitate albumose—or rather albumoses—I add one gram of ammonium sulphate to ten cubic centimeters of decantate, dissolve the salt by heat, and cool. As the mixture cools, a turbidity forms, due to albumose. This is very light and is precipitated only with the greatest difficulty; in fact, I do not usually try to clear it absolutely by the centrifuge, but simply estimate what is thrown down by 10,000 revolutions; 1 per cent. may be taken as the normal maximum.

To precipitate peptones, I employ phospho-molybidic acid, which makes a very bulky precipitate. I should prefer tannic acid, the precipitate from which is only about a sixth as bulky, and tannic acid is the reagent usually recommended by chemists, even in experimenting with stomach contents; but they forget that tannic acid also precipitates starch, which is almost invariably present in chyme. This little oversight alone cost me several months' time, as it necessitated throwing out quite a series of observations. Normally, the precipitate with phospho-molybdic acid is from ten to nearly thirty per cent. of the filtrated chyme. This relatively enormous bulk suggests that something else than peptones is precipitated, and it was only after careful search of chemic literature and consultation with chemists that I became convinced that we could rely on this reagent. Phospho-molybdic acid precipitates alkaloids and certain biliary constituents, but it is impossible that there should be anything of a non-proteid

nature in the filtered chyme, in sufficient quantity to interfere with the result desired. For instance, to show that ordinary saline matters and waste that might be present in the stomach could not cause a precipitate, we need only add phospho-molybdic acid to urine, when we find a reassuring absence of any precipitation.

You will ask what practical result we can derive from such an examination. The method is comparatively simple, and by it we can tell exactly how much digestive work the stomach is accomplishing. In general, we shall find an excess of lower forms of proteids in cases of subacidity and deficient formation of ferments. For instance, in cancer, we should expect at least 2 per cent. of acid albumin, probably as much albumose, and only 5 or 10 per cent. of peptone, by bulk. We must also bear in mind that an excess of an end-product may mean either unusually good digestion or poor absorption. A. L. B.

GENERAL PHYSIOLOGY.

RAYMOND PEARL.

Books and papers for review should be sent to Raymond Pearl, Zoölogical Laboratory, University of Michigan, Ann Arbor, Mich.

Driesch, H. Studien über das Regulationsvermögen der Organismen. 5. Ergänzende Beobachtungen an Tubularia. Arch. Entwick.-Mech. **11**: 185–206, 1901.

In this paper are collected the results of several sets of experiments on the hydroid *Tubularia mesembryanthemum*, all having as a general problem the regulatory processes of the organism. The first point considered is the number of tentacles formed in successive oral reparations. In the experiments the polyps were cut off and formed again five times in succession. In each successive reparation the average number of tentacles is less than in the preceding one. The difference in the number of tentacles between the original polyp and the individual resulting from the first reparation is greater than that between the individuals of any of the succeeding reparations. It is believed that this difference between the original hydranth and the subsequent formations is due to differences in nutritive conditions in the two cases. The second point determined was that fewer tentacles are formed on the polyp at the oral end of an aboral piece of stem than on the oral polyp of an oral piece, and that the number of tentacles of a polyp formed at the aboral end of an oral piece was less than in the case of oral polyps of either piece. From experiments with different lengths of stems it appears that, the longer the piece of stem is, the more tentacles the polyp formed on it has. The author repeats his former conclusion that the "red substance" is the "means" by which the regulatory processes are effected in Tubularia. All the facts of tentacle formation are explained as due to the greater aggregation of this formative "red substance" at the oral end of any piece of the hydroid, whether original or secondary (resulting from operation). The next main topic of the paper is the healing of wounds in the perisarc. If the perisarc is removed over a certain area of the coenosarc the wound heals very quickly.

This quick closing of the wound is thought to be due, in the first instance, to the elasticity of the healing tissue. It was found that small pieces of stem without perisarc were capable of regeneration. In some cases pieces about 1 mm. in diameter developed into complete polyps bearing tentacles. The last general subject considered was the reparation of pieces of the stem split longitudinally. The method of carrying out the experiments was to divide the aboral two-thirds of the animal into two cross pieces, and then to split longitudinally the more aboral of these two. The polyps produced by each of the split pieces are symmetrical. The number of the tentacles formed by each of the three pieces was determined, and it was found that the sum of the tentacles produced on the split pieces was always greater than the number produced by the intact, oral pieces of the same animal. The reason for this appears to be found in the relations of the surfaces of the pieces. The sum of the volumes of the split pieces is evidently equal to the volume of the unsplit piece, but the sum of their surfaces stand to the surface of the uncut piece in the relation of $\frac{10}{7}$, as they are approximately cylindrical and of equal length. On the other hand, the relation of the number of tentacles in split and unsplit pieces is $\frac{25.08}{19.36}$. Reducing these two fractions to a common denominator, we have $\frac{190}{133}$ and $\frac{175}{133}$. The close similarity of these fractions indicates the validity of the conclusion that the number of tentacles formed is directly related to the extent of surface of the formative basis. The paper is one of great interest and importance. R. P.

Holmes, S. J. Observations on the Habits and Natural History of Amphithoe longimana Smith. Biol. Bull. **2**: 165–193, 1901.

This paper describes quite fully the behavior and general "natural history" of the amphipod crustacean, Amphithoe. The scope of the work is well indicated by the titles of the sections, which are as follows: "Specific Description, Habitat, Enemies, Food, Movements, Nests and Nest-Building, Moulting, The Seat of Smell, Color and Color Changes, Sexual Habits, The Disposal of Excrement, Timidity and Pugnacity, Phototaxis, Thigmotaxis, The Instincts of the Young, Regeneration, The Effect of Cutting the Animal in Two." Some points of particular interest are: 1. Amount of food eaten. It was found that the animals eat in twenty-four hours an amount of food, as estimated from the excrement voided, equal to approximately one-tenth of their own bulk. 2. Method of keeping a straight course while swimming. The constant state of partial flexion of the abdomen, together with the beating of the pleopods, tends to make the animal move in a curved path while swimming. This tendency is counteracted by the rotation of the body on the long axis through 180°, at frequent intervals. The result of the frequent repetition of this rotation on the long axis is a fairly straight path, having for component parts arcs of circles. This method of keeping a straight course resembles that shown by some of the Protozoa. 3. Nest-building. The nests, which are tubular structures open at both ends and attached to water plants, etc., are constructed from a secretion which is poured out from glands in the first two pereopods. This secretion hardens as it comes out, and is fastened at different points by the pereopods touching their ends to the object on which the nest is being constructed. New nests are built in a very short time, "often

in less than a half hour." 4. Sense of smell. The most important olfactory organs are the first antennæ, but from the fact that there is some reaction to olfactory stimulation after the removal of the antennæ, it is thought that there is a second organ for this sense. The author, however, did not succeed in precisely localising this second seat of "chemo-reception." 5. Color. Descriptions are given of several color varieties of Amphithœ which exist in nature and of the relation of the pigments in these varieties. The color changes adapting the animal to its surroundings are less perfect than those shown by the prawn, Hippolyte varians, as described by Gamble and Ashworth (Q. J. Mic. Sci. N. S. **43**: 589–698, and this Jour. **4**: 1182–1183). 6. Thigmotaxis. Amphithœ is very strongly thigmotactic over all parts of the body. The author believes that this thigmotaxis forms the basis of many of the animal's instincts. 7. The young animals soon after hatching show most, if not all, of the instincts and peculiarities of behavior exhibited by the adults.

The paper is a good example of the tendency, which is becoming strongly manifest, to return to the old "Natural History" view point, and, by the application of modern methods of thought and investigation, to attempt to solve the same sort of problems as those at which the "naturalists" of the early part of the century worked.

R. P.

Yasuda, A. Studien über die Anpassungsfähigkeit einiger Infusorien an concentrirte Losungen. Jour. Coll. Sci. Imp. Univ., Tokyo. **13**: 101–140, 1900.

This paper deals with the results of a study of the power of acclimatisation of some infusoria to chemical media. A considerable amount of chemical acclimatisation work has been done on the lower Algæ and Fungi, but hitherto there have been no extensive results from correspondingly low animal forms available for comparison. Some of these needed results this paper presents. As objects of experimentation the following species of infusoria were employed: *Euglena viridis*, *Chilomonas paramœcium*, *Mallomonas Plosslii*, *Colpidium colpoda*, and *Paramœcium caudatum*. Cultures of these infusoria were put into solutions of milk sugar, cane sugar, grape sugar, glycerin, magnesium sulphate, potassium nitrate, sodium nitrate, potassium chloride, sodium chloride, and ammonium chloride. The solutions of these substances were of different strengths, beginning with very low concentrations and going up to those in which death occurred immediately. In all cases observations were made on the length of time the animal lived in the solution, the changes in structure, the effect on multiplication and movement, etc. Detailed accounts are given of all experiments, but only the most important results will be mentioned here. It was found that in isotonic solutions all the different substances have nearly the same effect on the same organism, but this relation is only an approximate one. The maximal limit of concentration to which infusoria can become acclimatised is considerably lower than in the cases of the Algæ and Fungi. It is noteworthy in this connection that Euglena showed the highest resistance capacity of any of the forms studied, while it is of course, structurally, more closely related to the Algæ than any of the others. Increase in concentration is accompanied by a checking of the multiplication of the organisms; by a retardation of the movement; by an increase in the size of the vacuoles, and chromatophores. In strong solutions the body

of the infusorian becomes rounded and uneven in contour, and there is a tendency, as the concentration approaches the maximal point, for the chromatophores or amylum bodies to join together and form large masses.

A method is described for making pure cultures of infusoria. A culture fluid is prepared according to the following formula:

Meat extract	1 gram.
Cane sugar	20 grams.
" Concentrated, cooked infusion of *Porphyra vulgaris* "	250 c. cm.
Distilled water	729 c. cm.

This culture fluid is sterilized and the desired infusoria are introduced into it by means of a capillary tube. The capillary tube can be examined under the microscope, and only that part of it which contains the species wanted is emptied into the culture fluid. The medium is thus inoculated with a single species and by multiplication a pure culture results. This method is stated to be very successful in practice. R. P.

Moore, A. Further Evidence of the Poisonous Effects of a Pure NaCl Solution. Amer. Jour. Physiol. **4**: 386–396, 1900.

The purpose of this work is to determine whether pure solutions of various electrolytes have the same poisonous effects on fresh water animals as they have been shown to have on those living in sea water. The organisms used were young trout, and frog tadpoles. The trout were taken just after hatching and immersed in solutions of known concentrations. The time of death as indicated by the cessation of respiration was noted and the results from different combinations of salts were tabulated. The results are entirely confirmatory of Loeb's work on other forms. It was found that pure solutions of the chlorides of Na, Ca, K, Mg and Li were poisonous. The poisonous effects of NaCl were antagonized by Ca, but the latter was not found, however, to be in itself necessary, since it made a sugar solution more harmful. K did not counteract the effects of Na, but was antagonistic to Ca used in small quantities. Sugar in weak solutions was as poisonous as NaCl in solutions of equal osmotic pressure, while in stronger solutions it was less poisonous. The solutions in which the animals lived longest were combinations of NaCl and $CaCl_2$, or of these two salts with the addition of KCl. The young trout lived indefinitely in distilled water, showing that no salts are directly necessary for the preservation of life. A point of interest was that in case of the trout the heart beat continued for some time after respiration had ceased. Many of the solutions caused a remarkable shrinkage in the volume of the frog tadpoles kept in them. R. P.

Galloway, T. W. Studies on the Cause of the Accelerating Effect of Heat upon Growth. Amer. Nat. **34**: 949–957, 1900.

It is known that an increase of temperature causes an increased rate of growth in many organisms. The purpose of this paper is to determine whether in accelerated growth due to increase of temperature, the imbibition of water and the anabolic metabolism are equally accelerated, and, if not, which of the two processes is more accelerated. Larvæ of *Rana sylvestris*, *Amblystoma punctatum* and *Bufo americana* were used in the experiments. Fertilized eggs were subjected to three different temperature con-

ditions: (1) 6°–8° C., (2) 12°–18° C. (12°–15° C. in Rana), and 22°–25° C. (20°–24° C. in Amblystoma). Measurements were made of the length, of the total weight when freed of superficial water, and of the dry weight, and the results were tabulated. It was found that the dry weight is practically unaffected by temperature, and that, therefore, the acceleration of growth accompanying a rise of temperature is almost entirely due to "the changed rate of imbibition of water." The maximum percentage of water in tadpoles reared in high temperatures is slightly greater than in those which have lived in lower temperatures. The maximum total weight of the animals reared in low temperatures is greater than that of those in higher temperature conditions. Animals kept for seven days in a temperature of 12°–15° and then placed in a warm chamber show a greater rate of increase of imbibition than those which have been in the high temperature from the beginning. R. P.

Jennings, H. S. Demonstrations of the Reactions of Unicellular Organisms. Science, N. S. **12**: 74–75, 1901.

In a report of a recent meeting of the Zoölogical Journal Club of the University of Michigan, the author gives an account of a series of demonstrations by means of the projection apparatus, of some of the more striking facts in the reactions of the unicellular organisms. Among many matters demonstrated, the most important were: (1) The collecting ("positive chemotaxis") of Paramœcia about a bubble of CO_2 and in mineral acids. (2) The spontaneous collections of the organisms, due to CO_2 excreted by themselves. (3) Negative chemotaxis to salt solutions. (4) The absence of orientation in chemotaxis. (5) The "motor reaction" of *Oxytricha*. (6) The essential identity of "positive chemotaxis" and "negative chemotaxis." In view of certain recent criticisms of the author's brilliant and fundamentally important results, this record of *demonstrations* of the facts in the case is especially welcome. R. P.

CURRENT BACTERIOLOGICAL LITERATURE.

H. W. Conn.

Separates of papers and books on bacteriology should be sent for review to H. W. Conn, Wesleyan University, Middletown, Conn.

Eckles. An Abnormal Fermentation of Bread. Proceedings of the Iowa Acad. of Sc. **7**: 165.

Juckenack, A. Beitrag zur Kenntnis des fädenziehenden Brotes. Zeit. f. Analyt. Chemie. Pp. 73–81, 1900.

Several instances of a slimy fermentation of bread appearing a day or two after the baking have been recorded and studied in recent years. Eckles has found the trouble quite common in a number of localities. The sliminess appears only in bread that is kept warm for some hours after baking, and makes its appearance on the third or fourth day. The bread is disagreeable in odor, becoming quite musty and stale, and extremely slimy. Eckles finds a number of bacteria present in such bread, but concludes that the trouble is due to two species: B. mesentericus vulgatus and B. liodermos, both of which organisms are found capable of producing such a

sliminess under proper conditions. The last organism produces a greater sliminess, but the first one a yellow color, which commonly accompanies this fermentation. They frequently act together. After studying the various sources which may serve as the cause of this infection, the author concludes that the trouble is probably due to impure yeasts. As a remedy he suggests either the use of purer yeasts, or the simple practice of cooling the bread directly after baking.

The second article here referred to describes a similar fermentation of bread, developing a very unpleasant odor and producing sickness among children when used as food. The cause of this slimy fermentation the author found to be neither of the bacilli mentioned by Eckles, but the well known species B. mesentericus fuscus. The author traced the trouble to the flour and attributed the infection to the fact that this flour had been allowed to stand after the milling in a damp, mouldy cellar, where it became impregnated with the bacilli. H. W. C.

Newfeld. Beitrag zur Kenntnis der Smegma bacillus. Arch. f. Hyg. **39**: 184, 1900.
Fraenkel. Zur Kenntnis der Smegma bacillus. Cent. f. Bak. u. Par. I, **29**: 1, 1901.
Russell and Hastings. The Thermal Death Point of Tubercle Bacilli. 27 An. Rep. of the Agr. Exp. Sta. of Wis.
Rabinowitsch, L. Befund von säurefesten Tuberkelbacillen ähnlichen Bakterien bei Lungengangrän. Deutsche med. Wochenschr. P. 257, 1900.
Korn, Otto. Weitere Beiträge zur Kenntnis der säurefesten Bakterien. Cent. f. Bak. u. Par. 27, p. 481, 1900.

The very great interest which has developed in recent years in regard to the tubercle bacillus and all other bacilli which have the same staining qualities, led the author to institute a careful study of the well known smegma bacillus, which has many points of resemblance to the tubercle bacillus. The smegma bacillus has shown considerable variation as studied by different observers, and Newfeld attempts to determine whether this indicates a number of species, or simply variations under different conditions. He concludes that among the smegma bacilli that there are at least two types, one resembling the tubercle bacillus, which holds its color in spite of the action of acids, and the other having a similarity to the diphtheria bacillus, whose power of holding the stain is less. In addition, there are numerous varieties which are probably simply polymorphic forms of these two types. These two types remain distinct in spite of changes in the medium in which they grow, but, nevertheless, a change in the sub-stratum produces very noticeable differences in the character of the different bacilli, affecting their power of holding stains in a considerable degree. The smegma bacillus, in short, represents two distinct types, capable of wide variations under different conditions.

Fraenkel has made a study of the same problem. His methods of study have differed from those of Newfeld, but he has reached practically the same conclusion. He finds that there are two types of the so-called smegma bacillus, one resembling the diphtheria bacillus, and the other adhering more closely to the characteristics of the tubercle bacillus. The latter only he regards as the smegma bacillus. He is inclined to believe that the former represents the pseudo-diphtheria bacillus, which has acquired the power of resisting discoloration by acids.

The question of pasteurization of milk for the purpose of destroying pathogenic bacteria is one of great practical interest to the dairy industry. Pasteurization at a temperature of 75° to 85° C, temperatures which have been commonly

employed, unquestionably produce certain changes in the milk and cream which detract somewhat from their value. The question whether pasteurization at a lower temperature of 60° C (140° F) is not sufficient to kill the tubercle bacilli has been investigated by several observers. The authors of this paper have tested this subject more carefully than others up to the present time, and they reach the extremely important conclusion that an exposure of tuberculous milk in a tightly closed pasteurizer for ten minutes to a temperature of 60° C destroys the pathogenic character of the tubercle bacilli that are present. When, however, the milk is exposed under conditions that enable a scum to form on the surface, the organism resists this temperature for a longer time. The authors, however, regard a pasteurization of milk at 60° C, for not less than 20 minutes, under conditions that prevent formation of a scum, entirely sufficient to destroy the pathogenic character of the tubercle bacilli present.

The author finds in a case of chronic pulmonary gangrene a species of bacillus which, in its microscopic appearance and in its staining properties, agrees with the tubercle bacillus. Its culture relations on various media are, however, different from those of the tubercle bacillus. For example, in glycerin agar it produces an intense orange yellow pigment. It is not pathogenic for guinea pigs and seems to be identical with one previously isolated by the author from butter.

This last article describes the characters of a tubercle-like bacillus, found in butter. The chief characteristic of this organism is that it will not grow in gelatin stab cultures at an ordinary room temperature. In this respect, as well as in the fact that it cannot be adapted to room temperatures, it agrees with the tubercle bacillus. For mice and birds the organism is not pathogenic, but for guinea pigs and rats it produces an infection which cannot be distinguished from true tuberculosis. The author believes that this organism, though not the typical tubercle bacillus, is a closely related variety. H. W. C.

NOTES ON RECENT MINERALOGICAL LITERATURE.

Alfred J. Moses and Lea McI. Luquer.

Books and reprints for review should be sent to Alfred J. Moses, Columbia University, New York, N. Y.

Ternier, P. Nouvelle contribution à l'étude cristallographique du cadmium et du zinc métalliques. Bull. Soc. Min. **23**: 18, 1900.

The crystals were obtained by distillation of their metals in a vacuum at low temperatures.

Zinc crystals were very small (less than 1 mm. diam.), quite clear and in hexagonal tablets, with periphery formed of rhombohedral facettes. $c = 1.356$. Nine forms noted.

Cadmium crystals showed a marked similarity to those of zinc, with $c = 1.335$; the zinc crystals, however, sometimes showed two prisms. Seven forms noted.

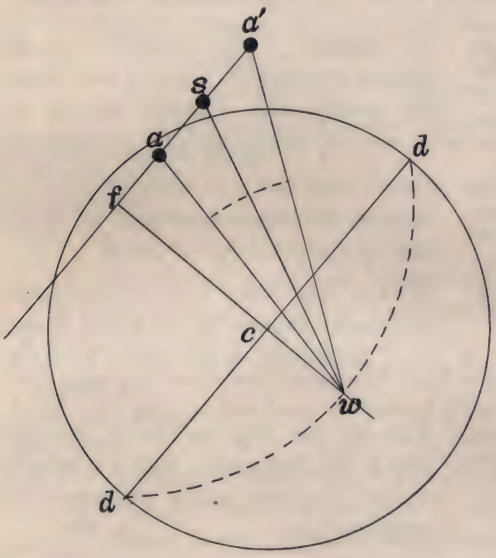
Both metals also yielded spherolitic aggregates with polyhedral facettes; and when the cooling was rapid showed confused, interlaced aggregates, with the free surfaces of the globules remaining spheroidal.

The "slipping figures" obtained with a needle point upon these facettes, were also discussed, their hexagonal nature being undoubtedly proved.

L. MCI. L.

Goldschmidt, V. Ueber Erkennung eines Zwillings. Zeit. f. Kryst. **30**: 346–351, 1898.

In previous numbers* reference has been made to the two circle method of measuring crystals and the gnomonic projection used in conjunction therewith. It may therefore be of interest to see how these can be applied to the recognition of twinned crystals.



The crystal is measured with one individual in normal position, with its prism zone normal to the vertical circle. Symbols are obtained for this individual in the usual manner, and then for the other either by comparison with the first or by separate setting up and measurement. The gnomonic projection is then made and the corresponding faces distinguished for instance by a $\underline{a}$, b $\underline{b}$, c $\underline{c}$, etc. If the grouping is a twinning there will be found a symmetry point s at the intersection of the zones connecting corresponding faces of the two individuals, and this point s will bisect the angle between any two corresponding faces. Furthermore it will be the pole of an important face or zone or, rarely, at 90° to such a face or zone.

If the poles of two corresponding faces are superposed, then s is either coincident with these or at 90° thereto.

If the two poles, a b, of one individual coincide with two, a' b', of the other, then s is the pole of the zone a b.

When it is not known which points are equivalent several poles of the one are connected by straight lines with one pole of the other, then all of the first to a second point of second, then to a third point, and so on. If several lines go through a common point, especially if it is the pole of an important face or zone, then the test is made whether this point bisects the angle between the two poles on any line.

The graphic determination of this equality in angle, and indeed the graphic measurement of the angle between any two faces in gnomonic projection, consists in finding the stereographic projection of the pole of the zone of the two faces

* Vol. 3, Nos. 2 and 7.

(this Goldscmidt calls the angle point) as follows, see Fig.: Let $a\ a'$ be the zone. Draw the diameters $d\ d$ parallel to $a\ a'$ and $f\ c$ perpendicular to $a\ a'$. From f with radius $f\ d$ describe an arc. The intersection w with $f\ c$ is the desired pole of the zone $a\ a'$ and the angle $a\ w\ a'$ is the true angle between a and a', and if s is a point of symmetry, then $a\ w\ s$ must equal $a'\ w\ s$.

In most cases the opposite faces are equivalent faces; sometimes, however, as in case of positive and negative tetrahedra, they are not equivalent. If the poles equidistant from the point s are non-equivalent, s is the pole of a plane of symmetry, but if the equidistant poles are equivalent s is the rotation point.

If no point of symmetry is found the group is not a twinning.

If s is known it may be made the pole face and the measurements so obtained will give corresponding points equidistant from s in the projection. A. J. M.

Stöber, F. Sur un procédé pour tailler des grains minéraux en lames minces. Bull. Soc. Min. **22**: 61, 1899.

On account of the objections to the opaque cements of Thoulet and Mann, the author uses Canada balsam for cement and describes a quick, convenient way of mounting and grinding the grains, so as to obtain thin sections. L. MCI. L.

Wallerant, F. Perfectionnement au réfractomètre pour les cristaux microscopiques. Bull. Soc. Min. **22**: 67, 1899.

Author describes apparatus as modified by Czapski.

Mallet, F. R. On Langbeinite from the Punjab Salt Range. Min. Mag. **12**: 159, 1899.

Author concludes that the potassiomagnesian deposit, at the Mayo mines, consists of langbeinite ($2\ Mg.\ So_4.\ K_2So_4$), intimately mixed with kieserite, picromerite and epsomite. L. MCI. L.

Fletcher, L. On a Mass of Meteoric Iron from the neighbourhood of Caperr, Rio Senguerr, Patagonia. Min. Mag. **12**: 167, 1899.

This is the first meteorite recorded found in Patagonia, and its latitude is the furthest south recorded for meteoric iron. L. MCI. L.

Hillebrand, M. F. Mineralogical Notes. Melonite (?), Coloradoite, Petzite, Hessite. Am. Jour. Sci. iv. **8**: 295, 1899.

The *Melonite* (?) gives formula $Ni\ Te_2$, but has same physical characters and is supposed to be identical with Genth's melonite (Ni_2Te_3) from the same source in California. L. MCI. L.

Medical Notes.

A Point in the Technique of Blood Counting.—I noticed an article in the December number of the Journal, in which the complaint is made that the cross lines in the Thoma-Zeiss Blood Count Apparatus are indistinct under the microscope. Will you allow me to make a suggestion, which is very simple, but which I have found to obviate this difficulty entirely? It is to lower the Abbe Condenser far below the usual position for using it, until the lines stand out distinctly. Possibly every one has discovered this for himself, but as I have not seen it mentioned, and it took me some time to formulate it into a rule for myself, I hope some one may be helped by the hint.

Cortland, N. Y. Dr. F. W. Higgins.

Willebrand, E. H. Stain for Simultaneous Staining of Blood Smears with Eosin and Methylen Blue. Deut. Med. Wochens. Jan. 24 and 31, 1901.

Eosin, 0.5 per cent. alcoholic, 25 c.c.
Methylen Blue, con. aq. sol., 25 c.c.
Acetic acid, 1 per cent., 10–15 drops

The erythrocytes are stained red, nuclei blue, neuthrophile granules violet, the eosinophile granules red, and those of the mast cells an intense blue.

C. W. J.

Lewinson. Method of Staining Fat. Vratch, **21**, No. 39.

1. Fix in Müller's fluid for two to three weeks.
2. Dehydrate in successive changes of alcohol, commencing with 70 per cent.
3. Imbed in celloidin.
4. Stain sections of 10 to 15 μ for twelve hours in following solution:

   Hæmatoxylin - - - - 2 grams
   Alcohol, absolute - sufficient to dissolve hæmatoxylin
   Acetic acid, 2 per cent. solution - 100 c. c.
5. Wash in water.
6. Transfer to 1 per cent. solution permaganate of potash and leave 10 to 15 minutes.
7. Wash in water.
8. Oxalic acid, 2 per cent. solution for five minutes.

If sections remain yellow or brownish black, carry through the permanganate of potash and oxalic acid solutions again. If no fat is present the sections are colorless. If sections contain fat they are slightly ashy or gray-violet in color. Under the microscope the fat appears gray-violet, while all other structures are unstained.

The following counterstain may be used:

1. After removal from oxalic acid solution, wash in water and stain for 24 hours in an ammonical solution of borax-carmin.
2. Acid alcohol 1 per cent. for 2 minutes.
3. Saturated alcoholic solution of picric acid, 1 minute.
4. Clear in alcohol, xylol, or oil of origanum.
5. Mount in Canada balsam.

Nuclei are stained red, protoplasm yellow, and the fat dark, almost black.

C. W. J.

Kockel. New Stain for Fibrin. Verhandl. d. Deutsch. Path. Gesell. **II**: 320.

1. Stain with Weigert's hæmatoxylin.
2. Counterstain in Weigert's borax-potassium-ferricyanide solution, diluted with three times its volume of water.

Fibrin stains dark blue, background light gray or bluish.

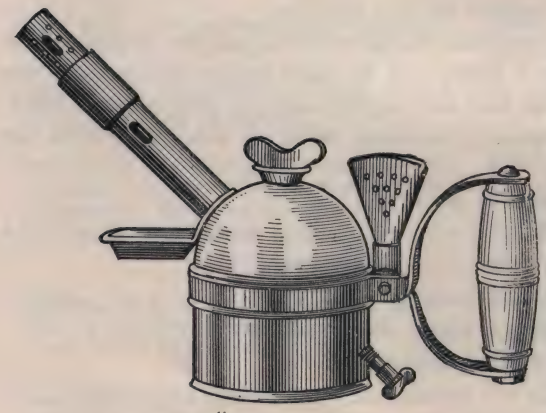
It is recommended that tissues be hardened in alcohol, sublimate or formalin before being stained by this method. C. W. J.

NEWS AND NOTES.

At the January session of the New Jersey State Microscopical Society, Dr. Byron D. Halsted read a very interesting and instructive paper on "The Movement of the Sap in Plants." The paper was followed by a fine series of lantern slides. During the past year it occurred to Dr. Halsted to prepare a list of questions concerning sap, any one of which might naturally occur to the "average layman" if he chanced to give the subject a little consideration. "What causes sap to rise in plants?" "Is there more than one kind of sap?" "Where is the sap in winter?" and a number of other questions of a like nature. Answers were received from representatives of a considerable number of professions and made rather interesting reading. Suffice it to say that the botanist was led to believe that a paper on the subject would not be amiss.

J. A. KELSEY, Secretary.

Recent experiments for obtaining pure cultures of algæ have shown that Cyanophyceæ grow rapidly and luxuriantly in a decoction of Zamia, with the addition of peptone and sugar.



THE "QUEEN" TORCH.

The accompanying figure represents a device which may be used as a suitable lamp for field work, and also as a substitute for the blast lamp in laboratories where gas is not available. A torch designed to meet the same purpose was figured and described by W. J. Morse in Vol. III, p. 986, of the JOURNAL. The "Queen" torch, manufactured by the Bridgport Brass Co., has two burner tips; one for a round and one for a "fish-tail" flame. There is an attachment for regulating the flow of gas, allowing the flame to be turned down while not in use. This improved torch is recommended by Prof Morse as one which satisfactorially serves all purposes for which it was designed.

In Vol. IV, No. 1, p. 1129, the name of Prof. J. G. Adami was erroneously given as Prof. Adann. In the same reference the first sentence of the third paragraph should state that the pamphlet "How to Collect Mosquitoes" was issued by the British Museum and sent to the Montreal Nat. Hist. Soc.

IT CAME BACK.

THE DOCTOR'S WIFE FOUND HER COMPLEXION AGAIN.

Coffee is no respecter of persons when it comes to the poisonous effects thereof. A prominent physician's wife of Monticello, Ind., says that coffee treated her very badly indeed, giving her a serious and painful stomach trouble, and a wretched, muddy complexion. Her husband is a physician of the regular school, and opposed to both tea and coffee, so he induced her to leave them off and take on Postum Food Coffee. The stomach trouble disappeared almost like magic, and gradually her complexion cleared up; and she is now in excellent condition throughout.

There are thousands of highly organized people who are made sick in a variety of different ways by the use of coffee, and most of these people do not suspect the cause of their trouble. They think that others can drink coffee and are well, and they can, but about one person out of every three is more or less poisoned by coffee, and this can be proved by leaving off coffee and taking Postum Food Coffee. In nearly every case the disorder will be greatly relieved or entirely disappear. It is easy enough to make a trial and see whether coffee is a poison to you or not.

The name of the doctor's wife can be given upon application to the Postum Cereal Co., Ltd., at Battle Creek, Mich.

CURED BY FOOD.

NATURE'S WAY TO GET WELL AND KEEP WELL.

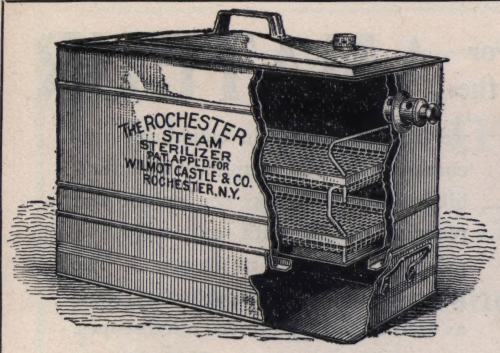
People who do not know how to select the right kind of food to sustain them become ill, and some sort of disease will show forth. It is worth one's while to know of these facts.

A young woman at Grindstone City, Mich., Mrs. A. P. Sage, began to run down while she was at school. She finally broke down completely, and was taken seriously ill with a number of different troubles. The stomach trouble was the most serious one. Her heart also troubled her so she had to sit up as high in bed as possible. This was caused, however, by her stomach. She says, "In the morning I would be so weak I could hardly move. I was kept on the simplest foods, principally liquids. After some months I seemed to get a little better, then I got worse, so that I finally was brought to the point of death from non-assimilation of food."

At this time a lady recommended Grape-Nuts Food. She says, "Little did I think what a help it was to become to me. I became greatly interested when I read the description on the box, that the food was pre-digested and in the shape of grape-sugar. I had been unable to digest anything starchy at all, but I began on Grape-Nuts, and it was so grateful to the taste, and soothed my stomach so well, that I have been using it ever since, and have never grown tired of it. My stomach trouble is entirely gone. I am much stronger now, and can ride a bicycle and take long walks, and have gained very considerably in weight, all of which I owe to Grape-Nuts Food."

Original Articles in the December Number, 1900.

ARTICLES IN JAPANESE.



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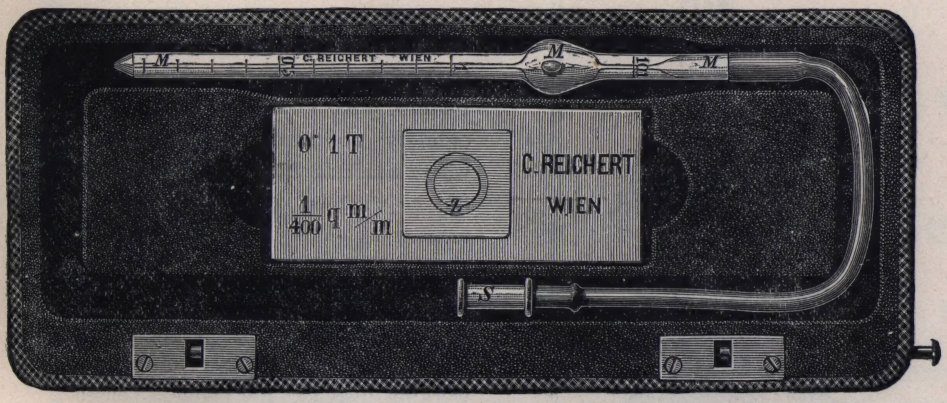

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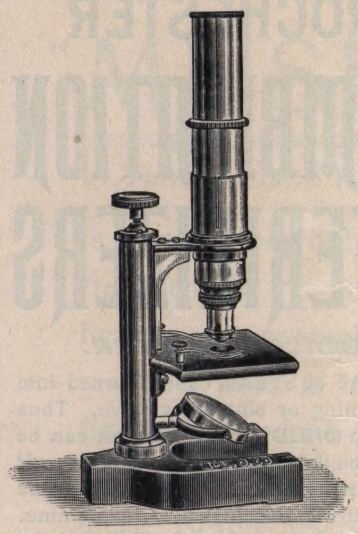

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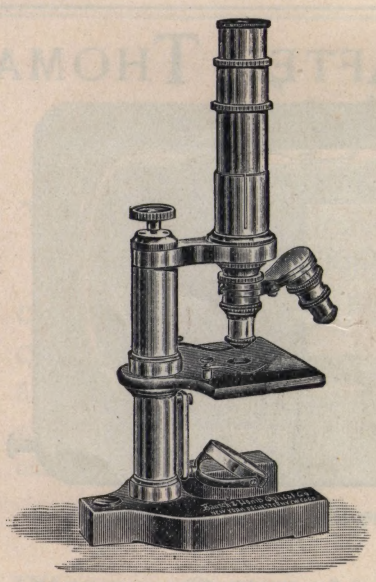

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